THE

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WHEN THE B.A. GOETH ABROAD.

IN 1911 the British Association will visit Portsmouth, and in the following year it will be fêted in suitable style by Bonnie Dundee, but should it go to Australia in 1914?

Such was the question around which centred one of the liveliest discussions held at the Sheffield meeting which came to a close on Wednesday. The Australian Commonwealth Government are prepared to spend £10,000 upon oversea expenses and to give free railway facilities between the different States, and, according to the suggested programme, a few days will be spent at each of the capital cities—Melbourne, Sydney, Brisbane and Adelaide.

Questions exercising the minds of those who had to vote whether the invitation be accepted or not included first: Is the idea in keeping with the objects of the Association? If so, is it practicable to hold a meeting at so great a distance from home? If practicable, that is, if it can be done in a reasonable time—three months is named—is it likely to be advantageous, first to its own members; secondly, to the great colony which has issued the invitation? As to the objects of the Association, these include "the advancement of science within the British Empire," which clearly justified several visits to Canada, one as long ago as 1884, and one to South Africa; why, then, should Australia be refused so high a privilege? The reason for such objection as has been raised is, in part, that distance lends a disenchantment. It is not that Australia is regarded with any less affection, or is esteemed less worthy scientifically of a visit, than was Canada or South Africa, but that the number going would be too limited, and would only include a selection of the leisured and *élite*, instead of the general body of the Association membership.

The question of how many would be able to spare three months naturally arises. Would there be a sufficient number of the recognised and *bonâ fide* scientists from this and other parts of the British Empire to assure a good scientific "missionary picnic," as one speaker termed it?

Does the Association exist for the favoured few who can always go on these foreign tours, or does it exist for all? Does it exist for the number who can exercise the maximum individual influence as the ambassadors of science, and shall the generous vote of the Australian Government be expended in *fêting* this select few—the well-known authorities? And if these are able to go, what is to happen to all those other members who stay at home? For these, every meeting held abroad, at which they cannot attend, means a deprivation of the benefits of membership. How many younger scientific members, who have the yearning that most of us possess to see the lands inhabited by increasing numbers of our kith and kin, would find a vacation visit to Australia a great boon! But the vacation is not long enough, and if it were, they cannot afford the heavy cost. Many an underpaid

lecturer or demonstrator, works foremen also are named in the same connection—and there are many of these interested in the Association—will, in this, bear out those who fearlessly stated their case last Friday in the presence of an assembly which had practically made up its mind.

At first thought the suggestion of one speaker of a simultaneous home meeting for the benefit of the too-much-occupied, and the young and impecunious, might appear to have something to recommend it, but on reflection one remembers that a British Association meeting as it has come to be understood, is altogether inconceivable apart from the hospitality which our public authorities and wealthy men lavish upon it wherever it goes, and any mere supplementary summer school meeting of scientific men while the "giants" were abroad, and the garden parties, receptions and so forth were wanting at home, would possess so little attraction as to inevitably make a small and, we fear, an unimpressive gathering. Some go to see the "giants" and hear them speak, some to partake of the hospitality provided, and some to seriously take part in the sometimes dull proceedings of the Sections.

All these and many more thoughts like them lead up to the one question: will science and scientific men in the United Kingdom suffer seriously if there is no meeting of the British Association within our borders in 1914?

Seriously we must come to the conclusion that it does not matter very much one way or the other. If the Commonwealth desires it, and the Association leaders desire it, it may, as someone said, cheer the lonely heart of hard-working, discouraged, pioneering scientists and University men in Australia, to get into touch with eminent authorities from Home, and to tell them of their difficulties; thus may the scientific advance of the world receive a stimulus from the cheering and the picnicing and the garden-partying. For the works foremen, demonstrators, university lecturers, and others, who are members, but have no meeting, let them possess their souls in patience—will they not get the report of the proceedings in due course?

There is always something very touching about an appeal from the Colonies. This string was played upon with effect last Friday, and, as one objector said, hearts were touched, while reason was unconvinced. The fact is that some members, while recognising that desire on the part of Australia was one of the inevitable consequences of past visits to other parts of the Colonies, feel that the foreign visits have become far too frequent during the past decade. We all have a very warm corner in our hearts for our Colonial kinsmen, and the acceptance has gone to the Australian Government as a unanimous one, the objectors having graciously withdrawn their opposition in order that such might be the case, satisfying themselves with having given forceful expression to the objection which undoubtedly many feel. Though the objectors were for a moment risking their popularity, we are convinced that their view will be respected in future decisions.

Our Australian friends will kindly take a note, so that as they greet our British scientists four years hence in the capital cities of the Commonwealth, they may spare a moment for a sympathetic thought for the poor stay-at-homes who cannot go so far, and therefore are deprived of the one event of the year for them—the annual meeting of the British Association for the Advancement of Science!

To many of our readers here, perhaps, the matter is of quite secondary interest, for the number of electrical men attending the Association seems to grow smaller year by year. But to our numerous readers in Australia it should not be so, for the educational, engineering and other scientific authorities in that colony will doubtless be looking forward to the visit with great interest.

The "Overseas" Journalistic Conference.

For science there is no geographical boundary line—the interests and pursuits of its votaries are identical in all parts of the world. We have sat in the presence of scientific representatives of several countries at times of international disagreement which threatened to end in war, but the outside discord has never once been permitted to intrude, indeed, its very existence has led to warmer expressions of the international spirit of science.

If this be true of science and scientists, what of the Press and those who write for it? We had nearly written "literature" with a capital L, but we remember how the pressman who has not written a book of a very high order is outside the charmed circle and is only a "journalist." However, there are journalists who wield a far greater influence upon the people of their day than do some who walk along the higher paths. With all our own and other's condemnations of newspapers which occasionally stray from the course of strictest accuracy, the fact remains that the newspaper, the magazine, and the trade and technical journal are, in the majority of cases, a power for good, one which the times have called into being, and one which is to-day absolutely indispensable, for peoples everywhere are clamouring for the news of the day and appropriate articles to guide them in understanding its significance. This obtains in every civilised country to-day; our common interests are the same. If a movement is to be a success, the co-operation of the Press must be assured. If a grievance is to be ventilated or a wrong to be redressed, the journalist is sought out, and he can dictate the issue if he act with force and circumspection.

We have no desire to belaud our own particular calling, but think it as well to write thus to-day when the fraternisation of the cult of the pen from many countries is about to begin in old England. During the last few days there has been arriving in London a large number of newspaper and other editors, including daily and weekly leaders of the people's thought in Australia and New Zealand, in Africa, in India, in Canada, United States, Egypt, China, Japan, to attend the great "Overseas" Conference of the Institute of Journalists, which opens to-night at the Hotel Cecil. Everything that wealth and organisation could do for the hospitable entertainment of our visitors during their short stay among us has been done, and we have no feelings of uncertainty as to the memories they will carry back with them on that score, and these recollections are not a negligible factor in their future influence upon the minds of men who only know what they know of us and our country because of what such writers serve up for their edification and instruction in the Press. As fellow journalists we bid them a very hearty welcome to our midst, and hope that they will have as enjoyable a time here as the Institute has striven to guarantee. We should like to offer them a little fraternal advice as to the need of the general reader for more precise information on scientific and manufacturing subjects, so that there may be less danger of the public being misled—unconsciously on the part of the reader and unintentionally on the part of the editor and the writer. But that will keep for a later issue. At the moment, we will be content with heartily wishing all our "literary" visitors a stay of boundless enjoyment and edification in what has been arranged for entertainment of eye and of ear, and for their comfort internally and otherwise.

THE PASSING OF THE CONTRACTOR: AN ALTERNATIVE.

[COMMUNICATED.]

The efforts of the I.M.E.A. to secure further powers to municipal electricity undertakings are apparently receiving a considerable amount of support; and as the principal privilege sought is that of trading directly with the consumers in installation material and apparatus incidental to the use of electricity, it must be concluded that in the event of Parliamentary powers being granted a result would be the immediate organisation of many municipal wiring businesses. Before this time arrives much energy will be expended by station engineers and contractors alike in the attempt to justify their relative positions, and the strained and unsympathetic relations which exist in so many places cannot fail to become aggravated to the confusion of the consumer and general detriment of the cause.

The movement in its present acute form may be said to have arisen from two principal causes—the competition with which the engineer is faced, rendering it necessary to force the supply for every purpose, work for which the average contractor is unsuited on the score of ability and financial standing; and, further, the publicity which has for various reasons attended the work of a few large undertakings in which trading and construction work has been made a special feature.

Before, however, committing their reputations to the successful operation of a business with the commercial side of which they are more or less unfamiliar, it may be worth while for engineers to consider if it be not possible to secure the desired results by less expensive and more just means than the replacement of the independent electrical tradesmen by municipal officials and workmen.

In a large undertaking the installation department is but one added to a number of important branches of the organisation, and given an experienced and well paid superintendent, it should be able to produce excellent results in spite of certain restrictions peculiar to municipal work which at times prevent the fullest advantage being taken of trading opportunities. When, however, the amount of business likely to be done is insufficient to keep a fair staff continuously employed, its difficulties are greatly increased, it becomes impossible to have a highly-trained manager, and the detail supervision will fall largely upon the chief engineer; there will also be a distinct tendency to develop "freaks" of business at times when the general work of the undertaking is at its heaviest. Under such circumstances the department may easily develop the faults which are condemned in the private contractor, and in its work it may lose sight of that precise subservience to the permanent interests of the supply department, which would be the principal value of a correctly organised trading branch.

Judging from the papers and discussions which have recently appeared in the Press, many station engineers are devoting their attention to the problems involved in this branch of work which they appear eager to undertake. The experience available so far on the subject is quite limited, and not in every case encouraging. One point appears, however, sufficiently obvious: in order to advance the interests of the supply, to cheapen and improve installation work, it will be necessary for the new department to be very quickly in a position to take up the whole of the existing local wiring business with facility for dealing with a considerable increase in its amount. In other words, the initial organisations should be equal to handling as much business as the aggregate of that carried on by all the existing local contractors; any gradual or tentative process of taking up the work would delay the benefits to the supply department, even if it did not temporarily place it in a worse position, owing to the discouragement of the private traders. At the same time, financial success would be difficult for the reasons that contribute frequently to the failure of the small private businesses, namely, that below a certain minimum of staff and turnover, it is difficult to buy advantageously, to hold stock for the prompt execution of orders which is so necessary where competition with gas is keen, and the necessity for keeping down standing charges would prevent the use of good class supervision and clerical assistance.

For these reasons the supply departments would be faced with the necessity of starting in a fairly large way and forcing business from the first, with the probable result that for a time difficulty would be experienced in obtaining suitable supervisors and workmen. No doubt the staffs of the threatened contractors would furnish many volunteers for municipal berths; in other words, the engineer would have to take the raw material, of which he now complains, and train it—possibly the best thing that could happen. But why not do it now and leave to the contractor his risks and his profits, which, under some system of "personal assistance," might grow sufficiently to give him a stability and satisfaction in his business. The lack of these is often the real reason why his methods are so unsatisfactory, and his canvassing efforts discounted in the eyes of the engineer, by a tendency to snatch immediate profit rather than to build up a permanent business by studying the interests of the consumer.

Any engineer who may feel disposed to try "mending" his local contractors before "ending" them might consider the methods of the large industrial organisations which sell their products directly to the public. Looking upon the local "electricians" as his representatives or travellers engaged in selling a highly technical commodity, he would take steps to meet them, preferably together, at regular intervals, and discuss latest technical practice and general commercial policy, confirming his views in brief but lucid bulletins through the post. A special feature of such meetings would be the discussions of difficulties met with in canvassing, and the provision of some arguments and replies for use in meeting the objections of the unbeliever.

In this way greater uniformity of practice and advice would be secured, and the contractor would find his status raised with the consumer, because his gospel would gain in orthodoxy and in agreement with the teaching of the station staff. Where it is the practice to issue printed matter advertising the uses of electricity, this may be very efficiently distributed through the medium of the contractor, and will at once have value in his eyes if issued in parcels printed with the name and address of the recipient; moreover, a most desirable uniformity and supervision over the statements put before the public will be gained.

Having secured something like coherent practice amongst all the electrical advisers in the area, the workmen might well receive attention. They are mostly quite open to learn the why and wherefore of the regulations which they daily break for a living, and a few simple demonstrations of the principles underlying the local regulations, illustrated with diagrams, and useful information on the latest novelties in material and practice, will generally be received with interest and attention. Such demonstrations should be restricted to the needs of the particular supply system on which the men work, and should be kept free from theory as far as possible. The tendency amongst the smaller wiring firms is to leave details largely to the men (who in many cases have no information given them beyond the position and size of lamps), and by getting in direct touch with them, and providing simple printed diagrams and instructions for daily use, the engineer may be saved much trouble, and the quality of the local work should be raised considerably.

In carrying out a scheme as outlined here, care should be taken to treat all contractors with perfect fairness, to avoid citing instances of bad work which may be recognised by competitors, or giving any information which may help one to the detriment of others, or lead to a rush of competitors for any prospective business, than which nothing is more annoying to intending consumers.

If by such means the contractor can be made to feel that there is a more promising future before him, that knowledge can be made to bear profit, and that a consumer does not necessarily cease to be a source of revenue to him when his first order is completed, some of the engineer's difficulties will begin to disappear; he will also possibly have gained sympathy for men who work hard, hampered often by limited knowledge, and knowing not the shelter of a permanent salary.

B.

Coventry.—A L.G.B. inquiry was held last week into the application of the T.C. for a loan of £1,282 for electric fire and police alarms; there was no opposition.

ORGAN BLOWING BY MEANS OF ELECTRICITY.

The use of electricity in ecclesiastical establishments has rapidly developed from the days when it was thought that a "dim religious light" was the only form of illumination that could fittingly accompany the act of worship. Nowadays it is recognised that electric light is one of the most

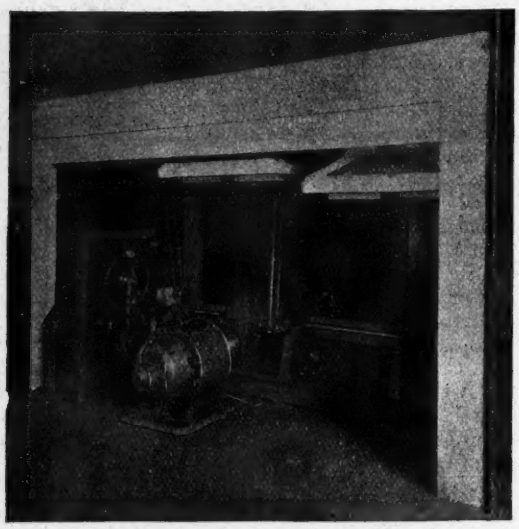


Fig. 1.—Sentinel Organ Blower Installation.

convenient and useful methods of illuminating church interiors. With the addition of churches to the list of electricity supply consumers, the question has, however, arisen as to whether anything can be done to improve what is probably one of the worst load factors on an ordinary town supply. Many engineers look upon church lighting as valuable only from an advertising point of view, considering that the cost of running the service and the necessity of supervising the internal arrangements, is hardly compensated for by the direct revenue obtainable from a lighting load which is only evident on the evening of one or two days of the week, and that in most cases only for the darker portion

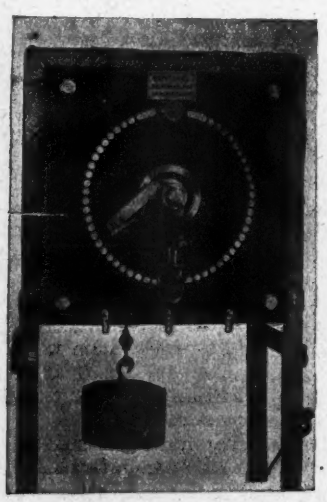


Fig. 2.—Controller for Organ Motor.

of the year. Under these circumstances it is not surprising that electricity supply engineers are divided into two classes upon this question. In the first are those who do not think this class of supply is worth going after at all, and in the other are those who are seeking means to bring other modes of consumption of electricity into vogue in churches and chapels. The following notes may be of interest to the latter class of engineers, and should certainly be useful to the large number of electrical contractors who are on the look-out for fresh methods of getting contracting work.

The question of electric organ blowing has for a long time been a very vexed one. Organ builders themselves are, as a rule, not yet so fully satisfied that electric blowing is so distinctly better than manual power or hydraulic blowing, that they are thoroughly prepared to incur the increased cost of the electrical plant, and this point is important when it is remembered that the majority of specifications are for the complete organ equipment, leaving the matter very largely to the organ builder as to what he may recommend, unless the electrical interests in the locality are sufficiently alive to the necessity of getting an electrical form of drive specified. There is no doubt, however, that as far as economy and reliability are concerned, an electrically-operated organ blower entirely outclasses hand labour and other cumbersome forms of motive power. A further complication is introduced by the fact that some people prefer a fan blower, while others prefer to utilise existing apparatus, simply substituting an electric motor instead of hand operation. In view of the fact that a fan, if throttled at the outlet, churns up the air in the casing and consumes, in many cases, nearly as much power as when it is working on a full outlet, the reciprocating type of gear applied to the feeding bellows with positive drive appears to be a better means of conserving power, provided that the rate of working the bellows can be regulated strictly in accordance with the amount of wind required at any time by the organ. The method of blowing excess wind to waste, which is sometimes adopted, is, of course, as wasteful of power as the method of using a fan blower.

In this connection it is of interest to notice somewhat in detail an apparatus which is the outcome of several years' work in conjunction with an organ building firm, and which, therefore, satisfies organ builders and organists as regards simplicity, strength and absence of running repairs. This gear is put upon the market by the Sentinel Organ Blower Co., of Newcastle-on-Tyne, and has in practice produced very good results.

Fig. 1 shows the Sentinel organ blower equipment, in which a motor of small horse-power, running at a slow speed on a continuous-current system, of supply operates by means of worm gear enclosed in an oil bath, a second motion shaft which transmits power by means of suitably placed cranks to the reciprocating motion of the feed bellows. These may be of any number required by the organ builders, and the

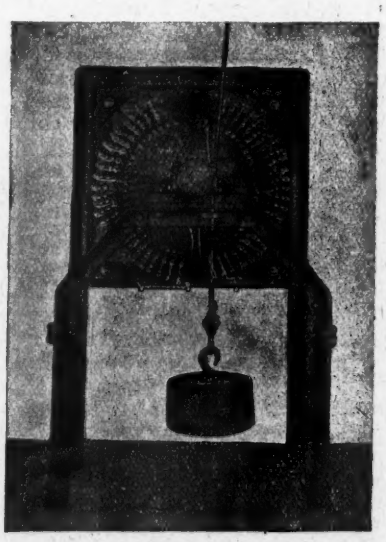


Fig. 3.—Back View of Controller.

speed and stroke can be made to suit the blowing gear. It is not necessary to emphasise the advantages of such an electrical gear as compared with the usual alternatives of gas and water power motors, inasmuch as its silence, cleanliness and instant availability places it far ahead of these rivals.

The chief feature of this gear is its method of control. This is effected by means of a flexible rope worked from the main reservoir, which passes round a drum attached to a

specially designed type of controller which is shown in fig. 2. The contact making arm of this controller is free from the shaft, and normally hangs in a vertical position by reason of its own weight. It will be seen, therefore, that when the current is switched on, a definite quantity of resistance is in series with the armature, giving a safe starting position for the rheostat. As the reservoir cover rises, the radial arm keyed to the shaft and carrying a pivoted armature comes into contact with a solenoid magnet fixed on the contact-making arm of the controller. After this contact is made, the two controller arms remain magnetically locked together until the current is interrupted, and the controller thus works as an ordinary series controller. The advantage of this method is, of course, that the ugly and inconvenient starting switch is entirely done away with; an ordinary switch at the console being sufficient to start and stop the motor.

The regulating resistance, which is placed in series with the motor, is a somewhat special arrangement, as shown by the back view of the speed controller, illustrated in fig. 3. It will be seen that the resistances are carefully designed to give high insulation and compactness. In the vertical position of the brush arm, a certain proportion

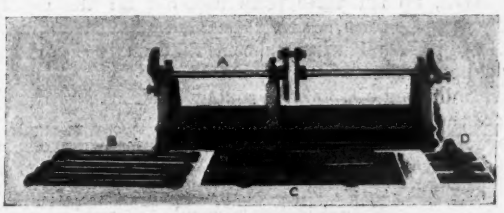


Fig. 4.—Details of Sentinel Blower Equipment.

of this resistance is in circuit with the motor, thus acting as a starting resistance. Upon the movement of the brush, however, and the insertion of more or less resistance in the motor circuit, the speed of the second motion shaft can be varied between very wide limits. This regulation of speed is carried on by very fine degrees, as a special point has been made in the design to provide an ample number of contacts on the regulator, and thus to bring down the danger of sparking to such negligible value that there is no risk of the contacts being burned or pitted in use, even in the position over which the contact arm hovers during the usual working of the organ. It will be seen that the number of strokes per minute on the feeder bellows is regulated automatically by the amount of wind that is in the bellows at any time, and hence at the rate at which it is required by the organ. The motor may be started by means of a single two-pole switch, which is operated by means of a dummy organ stop at the console of the organ, and the consumption of power is in almost strict proportion to the amount of wind required, this being a feature which is not obtained in some other systems of control.

Considerable care has been taken in the design to make everything as compact and light as strength and reliability will allow, and fig. 4 shows one or two typical parts of the organ blower mechanism, in order to illustrate the detailed care with which the work has been carried out. A shows the crankshaft and girder frame, B a set of connecting rods, C the bed-plate for the motor and worm gear, while D represents the shoes at the top end of the connecting rods for attachment to the feeders. The chief features obtained by the gear may be summarised as a positive drive, silence in operation, variation of speed relative to demand, sensitive yet durable control, compactness, simplicity and simple wiring arrangements. As regards availability for working at short notice, tests which have been taken have demonstrated the fact that from the time of closing the console switch to the instant of starting to blow with full power on the organ, only 10 seconds elapsed. These blowers have already found their way into several churches of various denominations, among which may be mentioned Free St. George, Dumfries, St. Hilda, Newcastle-on-Tyne, and Christ Church, Llandrindod Wells, and they are in practice giving completely satisfactory results.

ELECTROLYTIC HYPOCHLORITE AS A BY-PRODUCT TO ELECTRIC LIGHTING.

While the cheapness and efficiency of electrolytic hypochlorite as a disinfectant is universally acknowledged, it is singular that only one instance of its adoption by a municipal authority in connection with the electric lighting department is known in this country. The annual report of the Medical Officer of Health for Poplar (Dr. F. W. Alexander) for 1909, gives further particulars of this plant, which has now been working for four years in connection with the Poplar Municipal electric lighting station; and from these it is at once apparent that a saving can be effected by this method of obtaining disinfectant, as against buying it from manufacturers. The system adopted at Poplar is known as the "Hermite." There are three or four different methods of producing the fluid, all of which are the same in principle, but differ in the arrangement of the cell. The plant reported on consists of 40 cells through which salt water is circulated, the cells being run in series on a 220-volt circuit, and taking from 16 to 25 amperes. The plant is in duplicate, one set costing £430, exclusive of the buildings and external electric fittings. Rough labour in erecting, &c., was supplied by the Council. The total expenditure on buildings, fittings and plant since the commencement has been about £1,050. These two plants can deliver in eight hours, 400 gallons of hypochlorite solution at a strength of 4·5 to 6·1 grammes of chlorine per litre. The output per month during 1909 varied from 658 gallons in December to 4,326 gallons in August, or 173 gallons per working day. The cost of material on a yearly output of 27,216 gallons was £53 2s. 2½d., electricity costing £29 17s. 7½d. The bottles used for distribution are extra. A fresh use for the disinfectant has also been found in the public baths of the district, where it is used to eliminate any danger of infection being spread in the bath, as well as to oxidise the various impurities given off into the water before it is changed; 70 gallons of 2·5 gramme solution is added to a 70,000-gallon bath. This, which in any case, is a commendable precaution, may easily come to be regarded, in the case of populous districts, as a necessity. The substitution of hypochlorite solution for Condy's fluid in street watering would provide a substance equally effective, and without the disadvantage of corrosive effect.

From the central station engineer's point of view, a fair-sized motor would doubtless provide a more satisfactory load. As, however, every borough authority must necessarily be put to expense in the purchase of disinfectants—and this is a department in which economy may be attended with disastrous results—there is evidently a saving to the community by the Council becoming its own manufacturer, especially taking into account that a plant need only be laid down to deal with average requirements, the fluid remaining stable for three months with proper corking. The total space occupied by one set of cells at Poplar, including the supply tank, is 7 ft. × 7 ft., so that any spare space in the buildings near the generating station or at any other site of municipal activity may be utilised.

The hypochlorite solution produced at Poplar is used for various purposes, including treatment of water in swimming baths, street watering (of course, in a highly diluted form) and for distribution by the Public Health Department in cases of outbreaks of infectious diseases. The value, however, of electrolytic hypochlorite solutions does not cease with this already wide field. Sewage effluents entering watersheds whence water for drinking is subsequently abstracted, should undoubtedly be sterilised. Chemical sterilisation with calcium hypochlorite—*i.e.*, chloride of lime—is now in vogue for treating drinking water at Shrewsbury, Hornsea (Yorkshire), a large town in the Thames Valley and Cambridge, in this country; and at Harrisburg (Pennsylvania), Hartford (Connecticut), Jersey City (New Jersey), Minneapolis (Minnesota), Nashville (Tennessee), Quincey (Illinois), in the United States, and at Toronto and Montreal, in Canada. Sewage sterilisation by chloride of lime is being conducted at Boston (Mass.), Hamburg (Germany), Baltimore (Ohio) and other places.

D

Electrolytic hypochlorite will do all that chemical solutions will do, and perform the operation with greater celerity at no greater cost, because of the greater activity and oxidising power of the chlorine in the form of an electrolytically prepared solution. From the point of view of the municipal electrical authority, the subject is worthy of consideration as affording a small but steady day load. As we have pointed out, there are several good electrolysers on the market. The price per kilogramme of available chlorine for salt (the raw material) and for electrical energy for the electrolytic conversion of the sodium chloride to sodium hypochlorite, may be taken as varying from 9d. to 13d., the common cost basis being taken as electrical energy at 1d. per unit, and salt at 5 kg. for 1d. The initial outlay need not always be so high as that at Poplar if electrolysers using Acheson's graphite electrodes are used in place of platinum. Unfortunately for the progress of the industry, the firms developing electrolysers with the cheaper electrodes have not yet in this country met with the success that has been attained on the Continent. The prejudices to the adoption of sterilisation by municipal authorities for dealing with sewage effluents or water supplies are now breaking down as the result of the pioneer work of logical argument by Dr. Rideal and Mr. H. C. H. Shenton in this field, and Dr. Alexander's proved success in another sphere in Poplar.

ELECTRICITY SUPPLY IN MACEIO, BRAZIL.

By ANDREW McPHERSON.

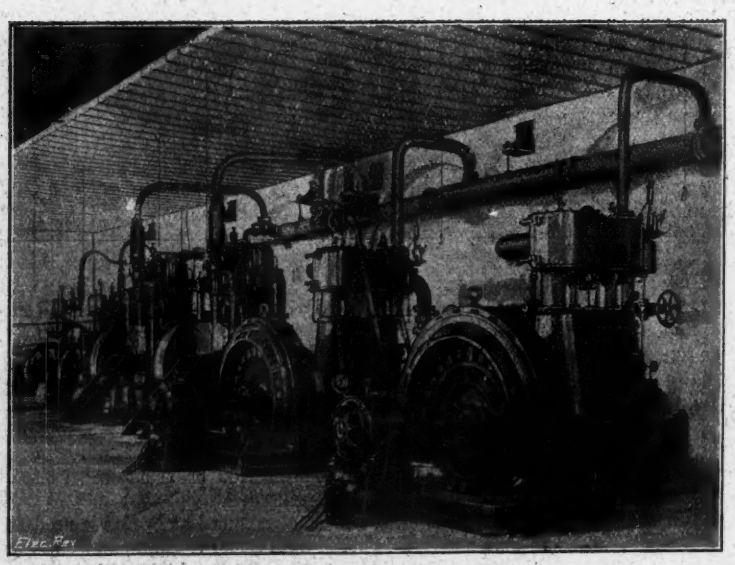
A description of the electric lighting system of Maceio, although neither a large concern, nor one representing the latest practice in the supply of electricity, will nevertheless be interesting as showing what can be done in many of the medium-sized towns of South America. The regulations governing the electric supply in most of the South American towns are either very lax or non-existent, and Maceio is one of these towns in which there are absolutely no restrictions of any kind regarding electricity supply. Given a free hand like this, cost naturally becomes the principal feature, governed only to a certain extent by reliability and efficiency, and with appearance as practically a negligible item. This is shown in the system adopted in Maceio, and more or less throughout Brazil—more in the smaller towns, less in the larger ones.

Maceio, which is the capital of the State of Alagoas, is situated on the east coast of Brazil, between Pernambuco and Bahia. It is like many other tropical towns, a widespread one, extending some 9 or 10 km. along the coast. The population numbers altogether about 35,000, but a portion of these live under very primitive conditions—many, in fact, in a kind of mud hut arrangement, where electric light, or indeed, any form of artificial illumination, would be a luxury far beyond their means. Taking this into consideration, and even allowing for the fact that there is no gas supply in competition, from 3 to 5 per cent. of the population is the most that one could expect to become consumers of electricity. At the present time, Maceio can only count about 1½ per cent. of the population as consumers, partly owing to the fact that the supply mains do not yet cover all the outlying districts, and partly because the electric supply company has only recently begun to develop on a reliable basis.

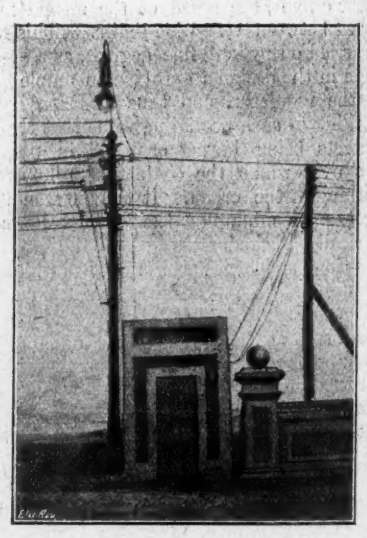
The electric light station of Maceio was first built 15 years ago, and has been more or less giving forth light since that date. It has had various vicissitudes, and been in the hands of several companies during this period.

The original equipment of the station consisted of three loco. type boilers with an evaporative capacity of about 1,700 lb. of water per hour each; two 50-kw. single-phase belt-driven alternators, of the Mordey-Victoria type by the Brush Co., driven by two compound open-type engines by the same makers. There were also two 12-kw. constant-current arc lighting dynamos, belt-driven by two compound, vertical tandem open-type engines, also by the Brush Co. This plant, up till three years ago, did all the lighting required for the town, which at that time consisted of about 50 kw. of private lighting and some 80 open type arc lamps for public illumination,

About the end of 1906, the concern again changed hands, the present company buying it up and altering the name to "Nova Empreza Luz Electrica." This company immediately commenced to scrap all the unreliable machinery, and put down new plant where required. They also entered into a contract with the municipality to supply the public lighting of the town, increasing the number of arc lamps from 80 to 230; the concession to be for 40 years. The various contracts for the new machinery were placed in England, with the exception of an order for about 100 arc lamps, which went to Germany. An English engineer was also engaged to supervise the rebuilding of the station and the reorganisation of the entire system. The new equipment is now in working order, the change from the old to the new having been made gradually, so as not to interrupt the supply of electricity to the town.



Generating Plant, Maceio Electricity Station.



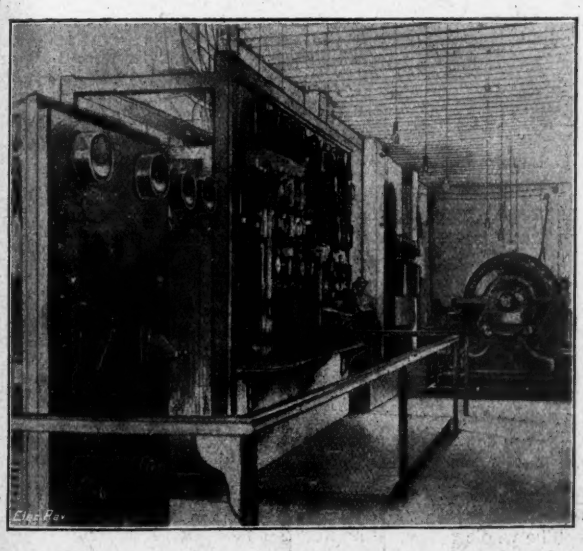
Transformer Kiosk and Overhead Mains.

The boiler house now contains five Cornish boilers by Galloways, each capable of evaporating 3,500 lb. of water per hour, working at a pressure of 130 lb. per sq. in., and with flue superheaters for raising the temperature of the steam 100° F.; a Green economiser consisting of 256 tubes is also installed, as well as an exhaust steam feed-water heater of Holden & Brooke's make. The feed pumps, which are of the double ram, steam-driven type, have a capacity of 1,400 gallons of water per hour, and were also supplied by

Galloways, as well as all the steam, water and exhaust piping. A new brick chimney 38 metres in height was built, the draught from the old one having been found insufficient for the increased boiler power required. This chimney was built by native labour under a local contractor, who, however, would only build it from the outside, this necessitating the use of scaffolding right round the chimney from the bottom to the top. When finished, but before the scaffolding had been removed, this chimney presented rather a weird appearance.

The fuel used for the boilers is a mixture of coal and wood, about 15 cubic metres of wood to a ton of coal. The wood obtained in Maceio is of a moderately hard quality and fairly high in calorific value, the price per cubic metre in the bunkers being approximately 3s. 6d., while that of coal is from £2 8s. per ton upwards, according to the ruling market price.

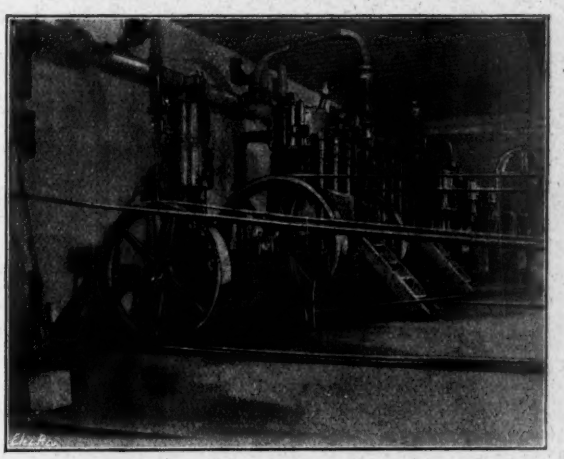
In the engine room, the old generating sets were overhauled and now act as stand-bys, the new machines added being three 100-KW. Belliss-E.C.C. sets. These engines are of Belliss & Morcom's usual enclosed compound type, working on a steam pressure of 120 lb. per sq. in., and developing at 500 R.P.M., 150 B.H.P. They are direct coupled to standard single-phase E.C.C. alternators, having an output of 100 KW. on a power factor of ·9, and working at 1,000 volts. The periodicity of the alternators was fixed the same as that of the original sets, namely, 100 cycles per



THE SWITCHBOARD, MACEIO ELECTRICITY WORKS.

second, this suiting the existing transformers and other instruments. Besides the alternators, the Electric Construction Co. also supplied the switchboard and transformers necessary for the extension. The switchgear, although adaptable for synchronising, is arranged on a system of change-over switches, so that parallel running is avoided at present; each machine, however, may be run on several feeders, or all the feeders on one machine.

The distributing system, both for high and low-tension, is on the overhead principle, the only exceptions being four "Pracas," or public squares, where underground cable is laid. Transformers are placed in brick-built houses at suitable centres, the primary and secondary cable entering and leaving these through special porcelain tubes near the roof. The secondary cables radiate round these centres, and feed the consumers within a reasonable distance. There are altogether 21 of these transformer chambers, the number of transformers actually connected being 40. The transformers are 6 and 10 KW. capacity, these being convenient sizes for handling, and also for feeding the various secondary circuits without under-running the transformers, and without feeding consumers far enough away to give an objectionable drop in voltage. In a few isolated cases, where it would be inconvenient either to make a new feeding centre or to feed from an existing one, small 1 or 2-KW. transformers are installed. These cases are very few however, for with transformer chambers well arranged, it is possible to cover a very large area with the secondaries. The finding of suitable sites for chambers is not, as a rule, a difficult matter in Maceio, where land is plentiful and æsthetics unknown. Within a radius of about 4 kilometres from the generating station the transformers are fed at 1,000 volts, and have ratios of 10 to 1. Beyond this radius a step-up transformer in the station increases the pressure to 2,000 volts, and



ORIGINAL BRUSH PLANT, MACEIO.

these outlying transformers are fed at this voltage, the ratio in these cases being as 20 to 1, thus making the consumers' pressure 100 volts. For the street lighting of the town, arc lamps are used, the number, as already stated, being 230. In the principal streets alternating-current flame arcs are used, these being of the "Excello" type, run 14 in series. In the less important streets "Crompton" 10-ampere open type alternating-current arc lamps are employed, while in some of the "Pracas" enclosed arcs are used.

The poles used for carrying the overhead wires are of wood, usually of a quality known as iron wood, and are 7 metres high above the ground. They are comparatively cheap in Maceio, and although in no way comparable with metal ones for appearance, they are serviceable, their life being from 10 to 15 years. Several methods of treating the bases of these poles have been tried, but the only one now used is that of charing the part buried, and after they are in position raising a concrete base round them a few inches above the ground level. This base not only keeps away any water which might gather round the pole and find

THE BOILER HOUSE, SHOWING WOOD FUEL.

its way down to the buried part, but it also adds, to a certain extent, a more finished look to the job. The same posts which carry the overhead cables, are also used for the arc lamps, the method of hanging them being from an iron extension fixed to the post, high enough to allow the bottom of the lamp to clear the top of the post. For trimming purposes the posts carrying the arc lamps are provided with

iron steps, the lowest step being within easy reach of a short ladder.

The wiring of consumers' premises is in all cases carried out by the lighting company, the material only being charged for. The system employed is simplicity itself, ordinary 600-megohm wires being run in wooden cleats wherever convenient. The style of the houses lends itself to this system, for the majority of them are single floor buildings, with a crude arrangement of tiling, and devoid of ceilings. This system of wiring might be considered as carrying simplicity to the extreme, but in a town such as Maceio, where the water service pipes are visible in almost any hall, and even in many drawing rooms, a few wires here and there do not make much difference to the appearance of the house. The secondary cables from the transformer chambers in most cases pass along in front of the houses, and where required, a tapping is taken off and led into the house, either above the main door or through any convenient window. This tapping goes to the main switch and fuse, and from these to the various points. This main switch is often the only switch in the house, except, perhaps, in the case of bedrooms, where a key lampholder is usually installed. With this system of wiring, a wireman can easily wire a house of half-a-dozen points in a few hours.

There are no meters used in the whole town of Maceio, the system of charging being a fixed rate per candle-power per month, with a reduction for shops closing before 10 p.m., and also an abatement on premises with over 80 C.P. installed. The rate is equal to nearly 4d. per C.P. per month, the reduction for shops being 15 per cent. and for houses with over 80 C.P., 45 per cent. The only method of checking whether a consumer is adhering strictly to his contract number and capacity of lamps, is that the old lamps must be returned to the company before new ones are sold, the new ones naturally being of a similar candle-power. This method is only workable because lamps cannot be bought within 200 miles of Maceio, except from the supply company. As an additional precaution, a station official pays an occasional visit to the various consumers, checking the number and capacity of the lamps. Cases where a higher candle-power lamp has been substituted for the original one are very rare, however, for the trouble experienced in obtaining lamps, otherwise than from the company, deters consumers from adopting this method, even if they are so minded. Private lighting is only supplied from sunset (which varies from 6 o'clock to 6.30) till 1 o'clock a.m., the public lighting hours being from half-an-hour after sunset until 4 o'clock in the morning.

The station, with the exception of the engineer, is run entirely by Brazilians, and although experienced workmen are not very plentiful, still, men capable of being trained are usually procurable, and these, in many cases, make fairly reliable assistants.

The whole system, from boilers to lamps, is arranged on the simplest possible lines, even to the extent of sacrificing efficiency, but always with the idea of reliability. That reliability has been obtained, is beyond doubt, for the new plant has been working for well over a year without the slightest hitch, and giving good results both financially and electrically.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Are the Wiring Contractors Asleep?

Aberdare is a go-ahead town of some 45,000 inhabitants. Messrs. Callender's Cable and Construction Co. are now laying cable over the town, and the inhabitants are naturally interested, and wish to know the exact cost of wiring their premises. There are five busy streets, full of high-class shops, and several private plants. There is, moreover, plenty of money in Aberdare. Is Aberdare now flooded with Cardiff and Newport contractors? Curiously enough, Cardiff and Newport contractors have not sent a canvasser so far, and it seems as though they were either very busy or fast asleep. The Clerk of Works has been canvassing, and has found out that the Aberdare shopkeepers are for the most part looking forward to the advent of electric lighting.

I trust, after this hint, that Cardiff and Newport contractors will come after business which is waiting for them. I also trust that they will not (to save a few pence per light) tender for carbon-filament lamps and jerry wiring, because, as I have hinted, the Aberdare tradesmen and Council are quite up-to-date, and will not tolerate anything but the latest metal-filament and flame arc lamps.

An Aberdare Ratepayer.

Prof. Hobson's B.A. Address.

"It cannot be too strongly insisted," says Prof. Hobson, "that a firm grasp of the *principles* as distinct from the *mere processes* of calculation is essential, if mathematics is to be a tool really useful to the engineer and physicist.

"There is a danger, which experience has shown to be only too real, that such students may learn to regard mathematics as consisting merely of formulæ and rules which provide the means of performing the numerical computations necessary for solving certain categories of problems which occur in the practical sciences." These words are a root and branch condemnation of the cult of "practical mathematics."

The dangers he speaks of may be illustrated from the *Proceedings* of the Institution of Electrical Engineers. There we find papers in which functions are differentiated as if dependent variables were independent. Partial differentials are confounded with total differentials. A sectional president offers a many branched function as a solution of a problem for which it gives approximate numerical values only for a small range as one branch in the neighbourhood of the particular example shown.

Most common and most dangerous of all, a first differential coefficient equated to zero under arbitrary geometrical conditions is supposed to give, infallibly, minimum costs or weights or whatever may be sought under the most general conditions of manufacturing. A past president offends thus.

Such are the fruits of the so-called practical mathematical teaching offered to engineers. The blame must be borne by the priests of the cult, and the chief blame should be laid on the arch-priest.

Before the writer lies a copy of Prof. Perry's "Calculus for Engineers." According to the introductory section, the aim is to teach only fundamental principles, but to teach these very well indeed. What audacity!

The whole reiterated aim of the book is to wheedle the student into a more or less uneasy familiarity with mere symbols and processes, and with the routine necessary for extracting numerical values. The clever students mentioned in the preface did not know the binomial theorem at the beginning of the session. It is, none the less, assumed in an early stage of the text.

The logarithmic function and its differential are baldly written down:—"Fourier's theorem can be proved to be true"; Gamma functions absorb two-thirds of a page; the rest is pretty much in proportion.

The honours student produced by this system usually astonishes one at the beginning by producing notebooks of work done on really hard problems in hydro-dynamics. He generally ends by failing to solve simple daily problems requiring a knowledge of elementary transcendental functions. One concludes that his knowledge is notebook knowledge. (There must be exceptions.)

The ordinary student keeps the book on his shelf, where it serves the same purpose as the masks worn by Chinese soldiers. In private he admits it is all Greek to him.

A characteristic trick is employed to coax the student out of his nervousness and self criticism in the face of the exponential function. The exponential series is written down in its simplest form, and differentiated without comment. Lord Kelvin is then quoted as saying that the exponential function represents phenomena which "follow the compound-interest law."

The psychology of the student's mind, no doubt, presents an association of the compound interest law with bankers,

and with schoolboy tasks, and a conclusion that an engineer can do what bankers and schoolboys do every day.

Prof. Chrystal has told of an Edinburgh banker whom he cross-examined, and whose conception of functionality was, he found, limited to that of simple proportionality. It is certain that even simple proportionality is a conception that has no abstract existence in the mind of the "clever boys" who work out compound interest sums by rule.

The engineer, then, who is beguiled by the mere illustration into believing that the principle involved comes easily and naturally, is like to receive no benefit.

It is bitter to say a single word in praise of a book that has done more harm to mathematical teaching than any other educational force. Yet it would prove an extremely convenient syllabus of applications to a student who had reached the honours standard in the study of pure mathematics and of physical applications, and who wished to take up engineering problems.

It is only necessary to cut out all the wheedling small-talk and the thin ghosts of demonstration, and to label it engineering applications of mathematics, "for honours men in pure mathematics only."

For the non-mathematical engineering student it might well be labelled "Poison."

R. A. L.

The Calculation of Illumination.

With reference to Mr. Toone's letter in your issue of August 12th in reply to my criticism of July 1st, a casual reader might be led to infer that he had made no serious mistake.

This, however, is far from being the case. Mean illumination is defined by—

$$\frac{\text{Volume of illumination}}{\text{Surface illuminated}}.$$

Obviously, Mr. Toone does not define it in this way, so that his calculations and results are all hopelessly wrong.

By a simple application of the integral calculus, the correct expression for the case considered by Mr. Toone can be found, from which it will be seen that his mean values, viz., 1·8 and 0·8, are much too high.

To suggest, as Mr. Toone does, that mean illumination can be obtained in the way indicated in the article, is a splendid "specimen" illustrating the necessity for criticism.

M. F. H. W.

August 31st, 1910.

Manchester Electricity Supply Department.

In your "Lighting and Power Notes" of the 2nd inst. you publish the strictures passed by the Manchester Ratepayers' Association on the action of the Local Government Board in dispensing with a public inquiry regarding a loan for extensions in the Manchester Corporation electricity department. You also publish certain admissions said to have been made by the Electricity Committee to the Ratepayers' Association.

Although I believe the action of the Local Government Board to be quite justified, I am not concerned to defend them. They can do that for themselves more ably than I. In any case, I take it that the complaint of the Ratepayers' Association should be addressed to Parliament, and not to the Local Government Board, as the Board are acting under the power conferred by an Electric Lighting Act passed so recently as last year.

I would, however, with your permission, wholly contradict the statement that "according to the admission of the Electricity Committee certain large consumers were supplied with current at cost price." No such admission has ever been made. The utmost that can be laid against the Electricity Committee is that, in order to render their plant in general more productive, they have quoted for and obtained large power loads at smaller relative margins of profit than in the case of, say, lighting users. The other users have, however, greatly benefited, as without the large power loads the cost of production would undoubtedly have been much higher. In other words, standing costs have been spread over a broader basis to the benefit of all consumers. Had not the special power business been secured, the standing costs then existing would have remained to be borne by ordinary users alone.

It will be obvious that a very complex question of electric supply economics is here involved; one, moreover, that does not lend itself readily to correspondence. I submit, however, that both on the scores of commercial stability and of rendering the largest possible service to the community, the Manchester Electricity Committee need fear no criticism.

The point raised by the Ratepayers' Association as to the return to the general body of ratepayers on the capital outlay is a totally different matter, and is one incompatible with the largest service to the community. Judging by Parliamentary action on various municipal Bills, the decision as to appropriation of profits will ere long be taken from local authorities. These bodies will apparently be limited to a maximum appropriation of 1 per cent. on outstanding debt. But apart from high policy, and taking things as they are, the Ratepayers' Association overlook one cardinal fact, viz., that of the £2,680,800 sunk, about £1,000,000 is for traction supplies in respect of which no profit is made, the Tramways Department being furnished with current at "cost." To insist on a profit here would be mere "window dressing."

S. L. Pearce,
Chief Engineer, Corporation Electricity Works.

Manchester, *September 5th*, 1910.

Time Meters for Cars.

With reference to the letter of Messrs. Venner & Co. in your last issue, we can confirm the opinion you expressed in your leaderette of August 28th, that the system of cheap time meters is preferred by some to that of ampere-hour and watt-hour meters. . . . We get a fair share of orders for our Acme time meters, and the letters we hold from users, and their annual reports, prove that the instruments are serving their purpose excellently.

The "Acme" Meter Co.
N. Gunn, *Manager.*

London, E.C., *September 5th*, 1910.

Overcrowding in the Ranks of Central Station Officials.

I was very pleased to see that three correspondents answered my letter on the above subject in the Review of the 26th ult., as, whether for or against, I like criticism.

With regard to the letter signed "A," I do not see how ex-premium pupils can gain their earliest experiences in a central station, "if" they have had a previous technical training or apprenticeship extending up to periods of five years. One statement contradicts the other. Neither do I agree that the majority enter stations outside their native town or are earnest triers. Nor is the fact that they gain their earliest experiences in a central station a guarantee that they make good station officials. I can count on one hand the really good men who have been premium pupils, and I think it will work out at about 1 in 20 of the pupils I have come in contact with.

I see that "J. P." has found that the influence of councillors, friends, &c., on behalf of the premium apprentice is a force to be reckoned with, and I should have liked his opinion as to whether he had found pupils to be workers or loafers.

"Electrical Engineer," in his first point (these pupils spend a year), goes off the track altogether. He goes on to say that some parents are not in a position to put their sons into the shops, so they enter a central station, serving several years in one, and, again, many years at others. What as? Premium apprentices all the time? or only for the first year say, and this probably in their native town. If this latter is correct, it proves my argument, and if the former is correct, I should say that it was quite as expensive as putting them through the shops. If, however, he means that they were not premium apprentices at all, and had no friends on the Council, &c., then I think that, as the very

thing which tends to make them idlers, has been taken away, they stand a chance of making really good men. Their length of experience, however, makes it impossible to compare them with the quotation cited by "Electrical Engineer." Also, as I say that they can make really good men, this discounts the contention that the whole gist of my article is to belittle station-trained men, "trained," I say, for my letter did not portray a trained man at all. I should also like some chief engineers' opinion of premium pupils, and I should like them to state whether, if the premium paid went to the rates, they would have the pupils in the station. That would certainly settle, once and for all, whether the majority of them were workers or not.

D. E.

I have been much interested in the correspondence on "Overcrowding and Injustice, &c.," during the last few weeks, and should like to offer a few remarks on the various letters.

I quite agree with "D.E." that a central station is not a place for an apprentice, premium or otherwise, because a station cannot teach engineering; it does not do the necessary variety of work. There is far too much of the premium pupil business, which, I think, is generally admitted, except by those chiefs who get the premiums.

I think it is also admitted that it would be to the advantage of station assistants if they had an association, something after the style of a trade union, to deal with the pupil and other matters, which has been suggested more than once in these columns; but it appears that station assistants have neither the loyalty nor pluck or enterprise to start a society, and it seems to me a pity they should take up so much space in writing about their troubles when they will do nothing towards ending them.

"Electrical Engineer" hits the right nail on the head when he says there is too much of the "where have you been?" and too little of the "what can you do?" It is no use in England wasting time studying the work in another department in the electricity supply business, unless you have influence; no wonder we hear of countries like the U.S.A. and Germany getting ahead of us.

I can quite believe what "A Poor Unfortunate" says, as I have had a somewhat similar experience myself, and wasted about six years of valuable time. I should also like to give some good advice to station assistants: I have had 12 years' experience in station work, obtained in England, Ireland and Scotland, and I have arrived at the conclusion that there is no place like old England for station work.

The cost of living, and rent, is higher in both Ireland and Scotland than it is in England, and it is extremely difficult to get a position in England again, from either Ireland or Scotland. Moreover, Englishmen are not wanted in these two countries, particularly in Ireland, as there are plenty of quite competent local men to supply all the stations there.

Returning to this question of injustice again; this is where an association would shine, as it could supply its members with private information before they took up new posts, and so prevent a bad chief injuring the career of a good assistant.

Justice.

September 5th, 1910.

The Proposed Association of Consulting Engineers.

Allow me to say that I entirely agree with your definition of a consulting engineer, and to subject such a man to an examination at his time of life would, as you state, be intolerable. Does the proposed Institution, or anyone, hold that this should be so?

If the promoters of the proposed Institution of Consulting Engineers have no qualification whatever, as "B.Sc., &c.," pointedly suggests, he may rest assured that they will be unable to gain the confidence of anyone sufficiently to "cleft any possibility of a truly eminent Institution of Engineers." Does "B.Sc., &c." mean to suggest that the degrees he mentions are more of a "hall-mark of *experience*" than membership of the Inst.C.E.?

May I also ask your correspondent how many of the numerous engineering D.Sc. and B.Sc. who, he states, treat the Inst.C.E. with such utter contempt, have the qualifications necessary for membership of the Inst.C.E.?

Harold Curry, A.M.Inst.C.E., A.M.I.E.E.

September 5th, 1910.

THE FULFILMENT OF PROPHECY.

[COMMUNICATED.]

A few years ago a paper was read before the I.E.E. in Birmingham and in London, which called the attention of tramway engineers to several matters closely affecting the maintenance of their overhead equipment. The authors (Messrs. Tweedy and Dudgeon) dealt with the subject from the point of view of men who had gained certain definite experiences from the behaviour of the materials which constituted the standard overhead equipment of that time; and they were bold enough to express dissatisfaction with various features of more or less importance in that standard.

Dealing with the wear of trolley wire, they showed by careful measurements taken at a large number of points, as well as by the exhibition of material examples, not only that the chief wear of importance took place at the trailing ends of ears—for that fact was known, yet not appreciated—but that this wear was due entirely to what they called bumping and arcing, and that the remedy was not to be sought in such aggravating palliatives as longer and longer ears, or

Some Tests of a Flexible Non-Fouling Ear.

anchors, nor in the substitution for circular wire of some fancy section, but in the adoption of a non-fouling ear for the suspension of circular section wire. They proved that the standard soldered ear, with its massive side flaps, was not only unnecessary for the safe suspension of the wire, but was the veritable cause of all the breakages of wire at, and a little way under, the points of the ears.

Experiments carried out upon a practical basis had disclosed to the authors, who, in turn, gave the information to a somewhat heedless world, that even with the smallest trolley wire in use—1/0 S.W.G.—a soldered ear could be applied which was in contact with the wire over its top semi-circumference only, and offered not the least obstruction to trolley wheels of any shape, age, or condition. Hitherto all ears were made of some brass or bronze mixture; and, while there was no difficulty in soldering these ears to the wire, a tendency was noticed for the two to part company at the ends after some time. This was due to the frequent bending of the trolley wire under the tension of passing trolley wheels, and to the continuous state of vibration in

which every more or less rigidly-hung wire, and in particular every tramway wire, is kept. The authors proposed to overcome this by making the whole ear, or at least the ends of it, of pure copper milled out to the exact shape of the wire, and tapered off at the sides and on the top, so that, when soldered, the two became as nearly one as if they had been drawn together in the mills.

Ears of this nature had been erected in several positions on a main line of busy tramway some months before the date of the paper mentioned, and they remain in position to-day, without the least sign of wear in themselves, and without causing the least wear to the attached trolley wire—a much more important consideration.

Now, the rapid deterioration of No. 0 s.w.g. circular wire under ever-growing traffic conditions led first of all to the adoption of No. 00 s.w.g. circular wire; and, as that seemed to wear, if anything, rather faster than the original, circular wire was abandoned largely in favour of sections known as "grooved" and "figure-eight," which were supposed to provide throughout their lengths a perfectly smooth path for the trolley wheel. It is doubtful whether this claim can be justified in the case of the first named, but figure eight wire has been more successful.

At the same time soldered ears were abandoned in favour of mechanical ears, upon the design of which a good deal of ingenuity has been exercised, and few have given soldered ears any further consideration, being indeed vaguely glad to get rid of them as the cause of their overhead troubles. These ears did not fail in their duty, because they were soldered, but because they were the wrong shape, and might have been made of more suitable material, and that is just where so many have been led astray. Probably there is no one who does not admit that circular wire is the best possible wire to use, but it has not been brought home to the great majority that the soldered ear, which is the true form of suspension for circular wire, is not necessarily an evil thing.

The illustrations show the truth of this statement clearly enough, and if the rumours are true which reach us from many parts of the country, there will be found no lack of engineers to welcome the return of the circular wire, for they are sick to distraction of the vagaries of grooved and figure eight wire.

Shall we ever forget that Manchester—was it not?—went on from strength to strength until the trolley-wire section became equivalent to 000000? And others have followed the lead of that great city.

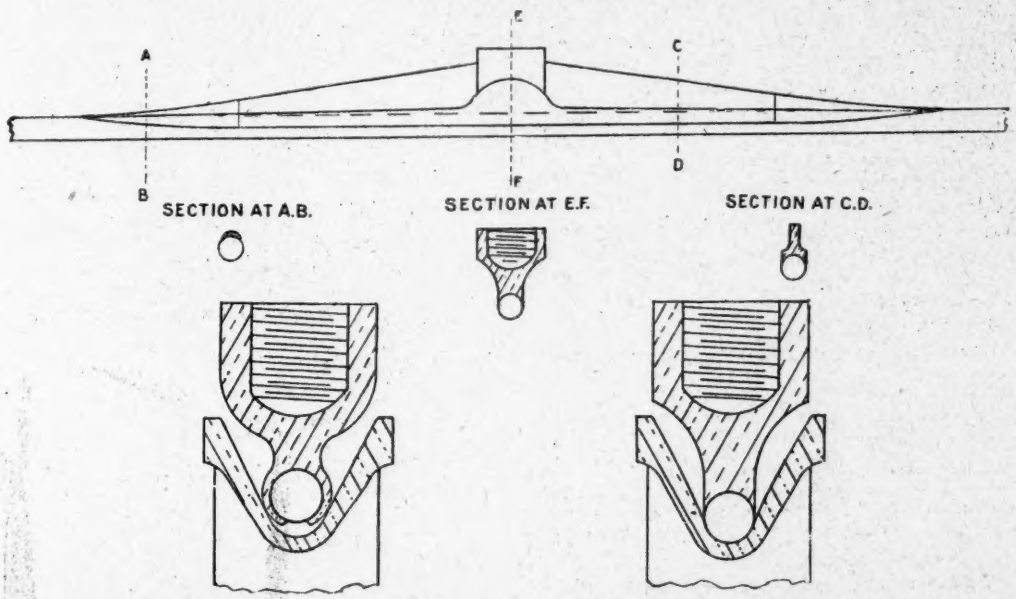
In another city, now said to be the second largest in the Empire, un-circular sections have run their rake's progress, and, worn-out, are being replaced by circular wire suspended by flexible non-fouling ears.

Not many years can pass before the same reversion has become general, and, for the sake of the welfare of our tramway undertakings, the sooner this happens the better.

Harking back to the paper, we find the authors warning tramway engineers to beware of pole ornaments—such as collars and bases—because of the rust which they hide; and it will be within the recollection of many that the suggestion was not treated very seriously. Can it be true, then, that in several towns the collars are being smashed off in order to save the poles? Beyond doubt this is so, and those who have not yet taken the matter seriously would be well advised to lift a few collars and see for themselves.

The authors of this paper also dealt, for the first time, with the electrolytic action which rives asunder the insulation on many lines, deteriorating it on all, and since then the subject has been investigated by scientists, who have placed the facts beyond doubt. Porcelain insulators with no interior metal parts have come into much greater use in consequence, and the time is not far distant when the old type will be extinct, helped, we may hope, by the tangential suspension of one of our most practical inventors.

Flexible Non-Fouling Ear



Section through Ordinary Ear and Trolley Wheel.

Section through Non-Fouling Ear and Trolley Wheel.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Lamrig" Washer.

We have received from the patentees and manufacturers, Messrs. Lambie, Wrigley & Co., of 116, City Road, E.C., some samples of their "Lamrig" spring-lock washers, which are recommended for use in machinery subject to vibration. The washer, which is at present made in $\frac{3}{8}$, $\frac{1}{2}$, $\frac{9}{16}$, $\frac{5}{8}$ and $\frac{3}{4}$ in. sizes, is symmetrical in form and places no side strain on the bolt.

"Salford" Ironclad Switchgear.

During the past year the General Electric Co., Ltd., has developed, and is now placing upon the market, a line of ironclad switchgear made throughout in their Witton Works, Birmingham.

The gear consists of two and three-pole switches, switches combined with fuses in the same box, ammeter and voltmeter cast-iron cases, which can be attached direct to the switch cases, conduit boxes which are used when all the conductors are brought in through a single conduit, and fuse boxes.

The switches, switch-fuses and fuses only are made in the following capacities:—15, 30, 60, 100, 200 amps. The switches and switch-fuses are made two and three-pole, while the fuses are made single pole only. All the gear is suitable for 500-volt circuits, and the cases are watertight and fool-proof (*i.e.*, the switch and switch-fuse cases are arranged so that the cover cannot be opened as long as the switch is "on," and the switch cannot be closed as long as the cover is open).

It will be seen from the illustrations that the gear has a workmanlike and substantial appearance. Fig. 1 shows a two-pole

00-amp. switch in the "off" position with the cover open. In this latter illustration the whole interior arrangement can be plainly seen. The switch is located in the upper part of the box where the leads from the line are brought in, so that if the switch is out, only the top or break contacts of the switch are alive. Between the switch blades are barriers of special fireproof insulating material, while the sides and the cover of the box are also protected with an arc-proof lining. The fuses of the porcelain expulsion type are all boxed in with strong fire-resisting insulating

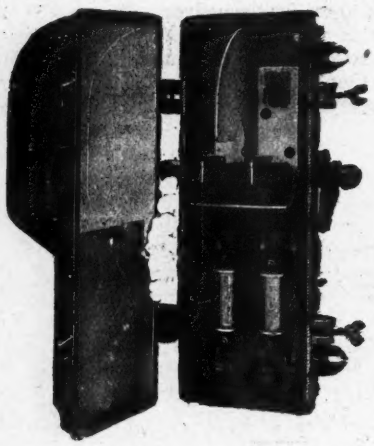


Fig. 1.—Two-pole Switch-Fuse.

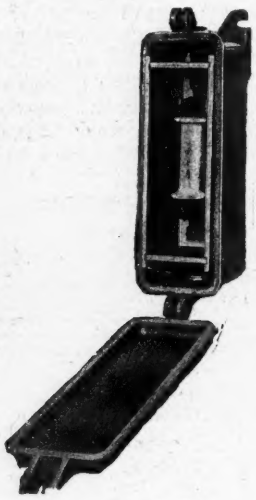


Fig. 2.—Fuse Box.

partitions, and a heavy plate of insulating material is fixed to the cover over the fuses, so that if the box is closed each fuse will be contained in a separate compartment of insulating material. The upper contacts of the switch, which are the only parts alive when the switch is "off," can be covered over altogether by a plate of uralite or similar material, which would have narrow slots to allow the switch blades to pass through. This arrangement makes it quite impossible to touch live metal when the switch case is open.

Fig. 2 shows the fuse box, which is used where separate switches and fuses are preferred. As mentioned above, these fuses are made single-pole only; they are protected by heavy partitions of insulating material in a similar way to the fuses in fig. 1. Fig. 3 shows a switch-fuse with ammeter attached.

Mining Panels.

Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, have found a considerable demand for the mining panels illustrated in fig. 4. The isolating switches occupy the upper chambers, and cannot be opened until the corresponding oil-switch (in the lower chamber) is in the "off" position; the oil-switch cannot be

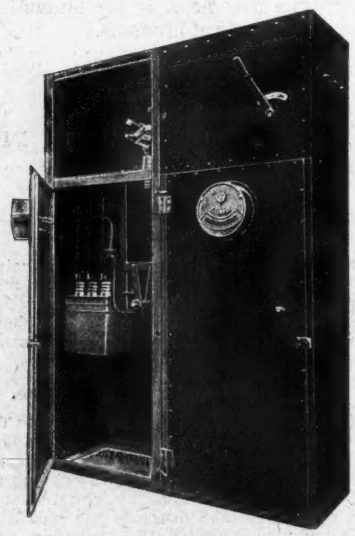


Fig. 4.—Reyrolle Mining Panel.

closed until the isolating switch is in again. The doors of the panels are interlocked, and cannot be opened until all the current-carrying parts are made dead by the opening of the isolating switch. Current and potential transformers can be fitted, and any instruments are accommodated on the front, as shown.

The design is of a substantial character, suitable for its particular use, and, where isolating switches are included, the safety of the operator is fully secured.

Westinghouse Silica Lamp.

This lamp is for running on direct-current circuits, and is somewhat similar in appearance to an ordinary arc lamp, but altogether neater and less bulky in construction. It has been designed mostly to meet the requirements of large lofty works and exposed situations, where its simplicity and general economical working make it most desirable in comparison with other forms of illumination. The lamp consists of a clear or opal

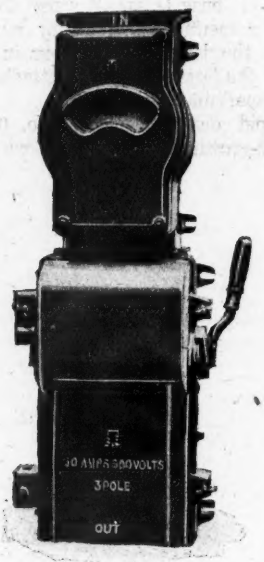


Fig. 3.—Switch-Fuse with Ammeter.

globe, which fits on the totally enclosed metal case, and can be lowered at will leaving the inside open for inspection, &c. A quartz tube A, of somewhat irregular shape, exhausted to a high degree of vacuum, and containing a quantity of mercury, is the source of light, the luminous portion in the smaller capacity lamps (1,200 H.C.P., 4 amps., 100-130 volts) being about 1¾ in., and in the larger (3,000 C.P., 3½ amps., 200-240 volts), about 4 in. The tube is

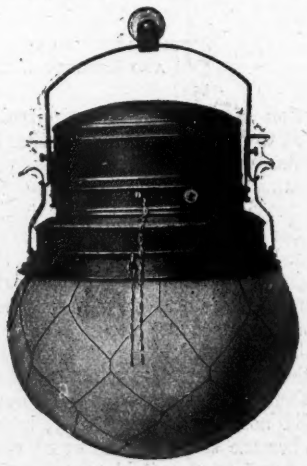


Fig. 5.—Westinghouse Silica Lamp.

mounted within the globe on the outside of the base, and is arranged so that it can be tilted and the mercury may be free to run to and from each end.

A solenoid B, whose plunger is connected to one end of the quartz tube, and an automatic cut-out *i*, are both mounted in the case.

An external resistance R is mounted in any convenient place.

On putting the lamp in circuit by switch I, the current first passes from the positive main through the resistance R, the cut-out *i*, and the solenoid B, back to the negative main, the solenoid causing the positive end of the tube to be tilted and the mercury to flow along the tube to the opposite end, thereby completing the tube circuit and lighting the lamp. As the cut-out coil is in series with the tube, this now comes into operation and immediately breaks the solenoid circuit. The quartz tube then falls back to its original position and remains illuminated until the lamp is switched off. As soon as the mercury in the quartz tube meets and the current in the tube is thereby started, a small portion of the mercury is vaporised. This solely constitutes the conducting medium in the tube and is the only source of light, there being a continual process of vaporisation and condensation whenever the lamp is burning.

As it is essential that the correct polarity should be observed to prevent damaging of the tube, means are provided in the lamp

itself which automatically ensure this, as under reversed conditions the lamp will fail to light up.

In comparison with arc lamps the Silica lamp gives an absolutely steady light of uniform quality, and is designed for running in

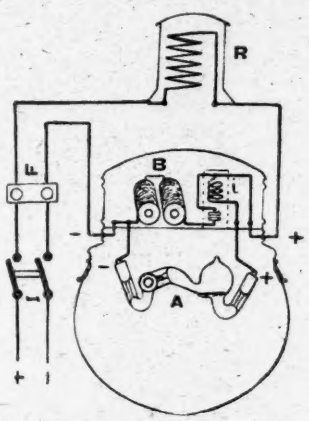


Fig. 6.—Diagram Showing Arrangement of Silica Lamp.

parallel, thus ensuring economical use. There is *no combustion of anything*, therefore *no deposit inside the globe*, and cleaning cost is entirely written off.

Extreme shadows are to a large degree eliminated; the light is bluish-white in colour, makes an ideal illumination for streets, markets, railway depôts, goods yards, wharves, docks, steel works, heavy foundries, factory yards, sheds, &c.

Full particulars are given in List No. 12, from which it appears that the comparative running cost per hour, with energy at 1d. per unit, for the open, enclosed and flame type arcs respectively, is 2·76d., 1·12d. and 1·82d., as against ·57d. for the Westinghouse Silica lamp, with the same C.P. conditions in each case.

Brush Quartzlite Lamp.

The Brush Electrical Engineering Co., Ltd., of 1, Kingsway, W.C., has recently introduced a Quartzlite lamp, giving from 1,800 to 2,500 C.P. on direct-current circuits. The burner consists of a quartz vacuum tube with positive and negative

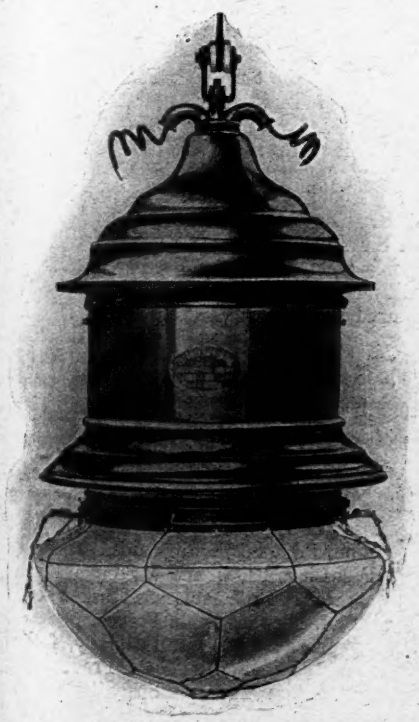


Fig. 7.—Brush Quartzlite Lamp.

mercury electrodes at opposite ends. The tilting of the tube, by switching-on and energising shunt-tilting solenoids, causes the mercury electrodes to unite momentarily in the tube, which then falls into its original position, an arc of vaporised mercury forming between the electrodes. At the moment when the mercury electrodes unite, a magnetically operated switch cuts out the tilting coils, thus preventing any waste through their being energised while the lamp is burning. The opening of the lighting switch automatically couples up the tilting coils again in readiness for further use of the lamp.

The burner will maintain its efficiency for at least 1,000 hours, and may have a life of 3,000 to 4,000 hours, giving an intensely brilliant diffused light suitable for illuminating the large interior and exterior spaces of industrial premises.

The lamp is made for 100—150-volt and 200—250-volt circuits, and has an average efficiency of about 4 C.P. per watt.

Our illustrations give the exterior (fig. 7) and interior mechanism, the latter view showing the renewable burner (fig. 8). Particulars of the lamps are contained in leaflets Nos. 110 and 111, issued by the Brush Co.

B.T.-H. Intensified Arc Lamp.

The British Thomson-Houston Co., Ltd., of Rugby, have recently introduced a highly efficient enclosed arc lamp, in which carbons of small diameter are used. In order to maintain a reasonably long life, the ends of two small positive carbons about ·25 in. diameter are brought into abutment, and the arc maintained at a predetermined position in relation to the reflector. No regulating mechanism is required for the upper carbons; the lower negative carbon is actuated by the lamp mechanism, which regulates the arc. Specially designed mechanism permits of the use of the small carbons, which the B.T.-H. Co. supply, and which give 50 to 60 burning-hours per set. The lamps run singly on 100/125 volts, two in series on 200/250 volts, or five in series on 500 volts, continuous current only, giving a steady white light suitable for colour-matching.

An intensified arc with single enclosing globe and reflector, and line resistance, when running on a 5-ampere 110-volt circuit has an efficiency of about 1·5 watt per M.H.C.P.—the maximum light being at 60° to 70° below the horizontal.

We illustrate in fig. 9 one of these lamps and resistance, of which details and prices are given in list No. 252.

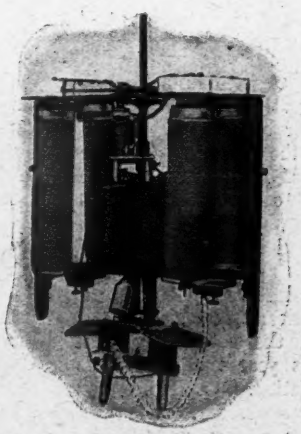


Fig. 8.—Mechanism and Burner of Quartzlite Lamp.

Fig. 9.—B.T.-H. Intensified Arc Lamp.

A French Investment Trust.—The Société Centrale pour l'Industrie Electrique, of Paris, of whose activity very little is known since its formation a year ago, has just decided to raise the share capital from £200,000 to £1,200,000 by the issue of new £20 shares, of which the sum of £600,000 is to be issued at once. Although a French company, constituted by the Comptoir National d'Escompte, the Société Générale, the Banque de Paris and the Union Parisienne, foreign undertakings are also interested in it as represented by the Belgian Société Financière de Transports et Entreprises Industrielles, the Berlin Electrical Enterprise Co. and the Swiss Bank for Electrical Enterprises, and the latter two as forming the A.E.G. group, held 30 per cent. of the original capital formation.

E

THE BRITISH ASSOCIATION MEETING AT SHEFFIELD.

After the reading of the sectional addresses to which full reference was made in our last issue, the consideration of papers began.

Thursday, September 1st.—The chief subject of electrical interest on Thursday, September 1st, was "The Price of Electricity," to which we refer in detail later. While the Economic Section was engaged thereon, Prof. W. Ripper was reading in the Engineering Section a paper on "The Testing of Lathe Tool Steels," and a demonstration followed at the author's laboratory in St. George's Square. In the Mathematical and Physical Science Section (A), a very large gathering listened with deep interest to the address of Prof. E. W. Hobson, F.R.S., and immediately thereafter settled down to a paper by Prof. Sir J. J. Thomson on "Positive Electricity," and two contributions by Dr. R. A. Houston on "A New Spectrophotometer of the Hüfner Type," and "A New and Simple Means of Producing Interference Bands." Other proceedings in this Section on Thursday, included an account of a new gyroscopic apparatus by Prof. A. E. H. Love. The Physiology Section, in its list for the day, had a report of the Committee on Electromotive Phenomena in Plants, and a contribution by Dr. Dawson Turner and Dr. T. George on "Some Experiments on the Effects of the X-rays in Therapeutic Doses on the Growing Brains of Rabbits."

Friday, September 2nd.—The Chemistry Section and Section "A" had a joint discussion on "Combustion," while a handful of engineers—which grew as time passed—in "G" were considering the Report of the Committee on Gaseous Explosions. The papers read in "A" at the joint gathering included the following:—Prof. W. A. Bone, on "Combustion"; Sir W. Ramsay and Dr. R. W. Gray, on "Molecular Weight of Radium Emanation"; Dr. J. A. Crowther, on "The Number of Electrons in the Atom"; Prof. A. W. Conway, "On the Convergence of Certain Series Used in Electron Theory"; Dr. J. W. Nicholson, on "Some Problems of Initial Motion of Electrified Spheres." In "G," after the "Gaseous Explosions" report had been briefly summarised by Prof. Bertram Hopkinson, a very interesting set of lantern slides was shown by Prof. H. B. Dixon, illustrating the firing of gases by adiabatic compression. The meeting then settled down to discussing the report. Mr. Dugald Clerk said that the object of the Committee had been to do for gas engines what had been done for the steam engine by all investigators, beginning from James Watt's day down to the present time. The Committee consisted of a body of experimenters who were all working at the same matter in different sections. They met eight or ten times a year, and compared their work, and found that the work of one member was throwing light upon that of others. In this way far better results were being obtained than if each worker had continued to work isolated. Prof. Unwin hoped that the Committee would go on with its work, and have the support of the B.A. to that end. Mr. Wimperis said that he did not know of any direction lately where science would be of such real assistance to engineering work as in this matter. Last year in the report they had the volumetric curve as the basis of calculation. This year the report was almost entirely confined to radiation. Other speakers included Prof. Coker, Captain Sankey, Mr. Rosenhain and Sir W. H. White, and after a few words from the chairman, Prof. Dalby, Prof. Hopkinson briefly replied. The observations of Sir W. H. White were fired at the general side of the question. He hoped that the Council of the Association would continue, and extend, its grants in aid of such important work, which involved great outlay. Sir William had a tilt at the newspaper Press for its recent silly season twaddle about the wonderful advance that was coming in the immediate future in the use of the internal-combustion engine in ship propulsion. He wished that those who penned these articles, would read the reports of the Gaseous Explosions Committee, and listen to what Mr. Dugald Clerk and others working in that field had to say regarding the difficulties. He supposed it always would be so. It did not matter much, but it was to be regretted that when such a mass of scientific information was available for anybody to read, those sensational and incorrect views of the present position of the internal-combustion engine should be put before the public.

The afternoon of Friday was occupied with the meeting of the General Committee, at which the invitation to go to Australia in 1914 was presented by Sir George Reid and Prof. Masson. The arguments used in the discussion, both for and against, are summarised on an earlier page of this issue. Eventually the opposition withdrew their objection, and a unanimous acceptance was reported to Prof. Masson (Sir George Reid having had to leave the building before the conclusion of the debate), who briefly expressed the gratification of the Australian Government at the decision. Next year's meeting will be held at Portsmouth, with Sir Wm. Ramsay as president, the invitation of Dundee being accepted for the year 1912.

On Saturday the Sections did not meet, and the Reception Room was dull and dreary, its occupants of the preceding days having given themselves up to visits to Chatsworth, Welbeck Abbey, Clumber, Derwent Valley Water Works, and so forth. Of Mrs. Ayrton's address to the women suffragists, Victor Grayson's gibes at the B.A. intellectuals for their inability to solve the unemployment problem, and Sir Oliver Lodge's largely attended lecture on the Bible, we will not stay to speak, for they are outside our accustomed province.

Monday, September 5th.—After the various diversions enjoyed since they adjourned on Friday, members settled down to business in the Sections in earnest early on Monday, and such subjects as the neglect of science by industry and commerce, and the electrification of railways were discussed.

Mr. Philip Dawson gave an extremely interesting lantern lecture on the electrification of the London, Brighton and South Coast Railway between Victoria and London Bridge. Prof. Silvanus P. Thompson, Sir William White, Mr. Charles Hawksley, and Mr. Dugald Clerk spoke in the discussion, and Mr. Dawson briefly replied.

The next paper was by Mr. H. E. Wimperis, on "The Use of an Accelerometer in the Measurement of Road Resistance and Horse-Power." One of these instruments was shown, by the kind permission of Mr. Worby Beaumont, fixed in position on his motor-car. Mr. Dugald Clerk made some comments.

This was followed by a short paper by Prof. E. G. Coker, on "Cyclical Changes of Temperature near the Walls of a Gas Engine Cylinder."

Section G then went to the room in which Section A was holding its meetings, and a joint discussion took place on the principles of mechanical flight. The subject was introduced by Prof. G. H. Bryan, and a hostile discussion followed, in which Sir William White, Mr. Dugald Clerk, Mr. Petavel, Mr. Scoble and Mr. Worby Beaumont took part. Prof. Bryan briefly replied.

Members attended the garden party given by the Lord Mayor and Lady Mayoress (Earl and Countess Fitzwilliam) in the afternoon.

Tuesday, September 6th.—In Section A there was an important discussion on Atmospheric Electricity. This was introduced by Dr. Charles Chree, and participated in by Sir Oliver Lodge, Dr. Shaw, and Sir J. J. Thomson. Dr. Chree spoke in reply.

Section A then divided into (*a*) Mathematics and Physics, and (*b*) Cosmical Physics and Astronomy. In the first-named sub-section, Prof. Féry's paper upon "An Auto-collimating and Focussing Prism, and a Simple Form of Spectrograph," was read. Prof. McLennan asked one or two questions, and Prof. Féry replied in French.

Mr. W. F. G. Swann, of Sheffield University, followed with a short paper on "The Magnetic Field Produced by a Charged Condenser Moving Through Space." Sir J. J. Thomson, Prof. Trouton, and Prof. Conway spoke in the discussion, and Mr. Swann replied.

Prof. McLennan read a paper by Mr. V. E. Pound on "The Secondary Radiation from Carbon at Low Temperatures." Dr. H. Stanley Allen delivered one on "Photo-electric Fatigue," upon which Sir J. J. Thomson and Prof. Crowther made some comments.

Dr. W. Makower, Manchester University, gave a paper

by himself, Dr. S. Russ, and Mr. E. J. Evans, upon "The Recoil of Radium B from Radium A," and Prof. J. C. McLennan gave the substance of some notes by himself, and Mr. N. Macallum, on "The Resolution of the Spectral Lines of Mercury."

In the Engineering Section (G), Prof. Coker contributed a paperon "The Optical Determination of Stress." Prof. Silvanus Thompson gave some interesting notes on "The Laws of Electromechanics." Mr. Bacon contributed a paper on "Heat Insulation."

These were followed by a paper by Prof. E. Wilson and Mr. W. H. Wilson on "A New Method of Producing High-Tension Electrical Discharges." A coil made on the principles laid down was shown, giving a 10-in. spark, the weight of the coil being only 10 lb. The coil was shown at the University in the evening. Prof. A. Schwartz also gave a paper on "A Machine for Testing Rubber by Means of its Mechanical Hysteresis."

The members were received in the evening at the University by the Duke of Norfolk (chancellor) and the Duchess of Norfolk, and at the Weston Park Museum by the Lord Mayor and Lady Mayoress (Earl and Countess Fitzwilliam).

The Price of Electricity.

[COMMUNICATED.]

In the paper which Mr. Edw. W. Cowan read on Thursday, September 1st, before the Economic Section of the British Association at Sheffield, he has put into scientific form a view that he has put forward on various occasions upon the subject of right principle in the important operation of pricing electrical energy.

It appears that there are now at least four distinct principles which receive support in various quarters.

1. The principle of ignoring the differential cost of supplying individual consumers according to the conditions of their demand. This principle finds its application in the "Flat Rate" system, &c.

2. The principle of charging each consumer as nearly as possible according to the cost of supplying him, as applied in the "Equal Profit" or "Maximum Demand" system, &c.

3. The principle of dividing supply into two or more parts, and treating one part as the principal product and other parts as by-products. This system, which does not appear to have been given a name, might be called the "by-product" system. (It is described by Mr. C. E. C. Shawfield in his paper entitled "Cheap Power Supply by Municipalities," which was read at the I.M.E.A. meeting at Sheffield in 1907.)

4. The principle, put forward by Mr. Cowan, of ignoring the separate cost of supplying different classes of consumer or individual consumers, and of regarding only the effect of each class of consumer, taken as a whole, upon the mean cost of the whole supply in relation to the mean price.

This system Mr. Cowan calls the "classified" tariff system.

It will be noted that the first two systems take no account at all of any differentiation in the strength of demand. The third system (the "by-product" system) does take account of the "demand" factor, within the prescribed limit that the whole of the *additional* cost (including fixed charges) of supplying consumers at by-product prices is to be covered by the price charged in the case of each consumer. It is put by Mr. Shawfield that the "rate is not debited with costs which do not properly belong to it."

The burden of the argument of the paper is that attempting to sell to each consumer, or to each class of consumer, according to the separate cost of supplying him is scientifically faulty, and that consequently the aggregate output will be reduced and the aggregate profit diminished in the process.

In the first six pages of the paper the subject is treated from the standpoint of economic science, two conclusions being arrived at which have an important bearing upon the question. They are as follows:—

1. When the cost of production of one unit of supply in a business is affected by the cost of production of the other units, no single unit can be said to have a separate calculable cost of production.

2. When prices are adjusted as closely as possible to the variations in intensity of demand, the greatest economic advantage is realised; because under these conditions the widest and closest correspondence between the incidence of supply and the incidence of demand is secured.

The first conclusion amounts to this. If the cost of production and distribution of electricity is *reduced* as the output is *increased*, we can arrive at a *mean* cost of production per unit, but we cannot attribute to any single unit a *separate* calculable cost. This conclusion can be arithmetically proved. Assume that the conditions of supply are such, in a supply works, that doubling the output would reduce the cost of production per unit by 25 per cent., and further assume that 1,000,000 units per annum are demanded for lighting purposes at 4d. per unit, and that the mean cost of production also amounts to 4d. per unit at that output, so that no profit is made by the undertaking. Then let us suppose that a factory within the area of supply offers to take another 1,000,000 units per annum at 2½d. per unit, under the same conditions in respect to "Load factor," "Diversity factor," &c., as the existing supply. With the output doubled, the mean cost of production per unit will be reduced from 4d. to 3d., *but only 2½d. is offered.* Is this consumer's offer to be accepted at a price which represents a "loss" of ½d. for every unit supplied to him? Under the "Maximum demand" system he must be refused, and yet, if we figure it out, we find that an *aggregate profit of* 500,000*d.* will be made by the undertaking with this customer on their mains, and, *ex hypothesi*, they can earn no profit without him! Under what law of ethics should this profit be refused? Who is injured by such a course being followed? Looking at the problem superficially, a profit is apparently made by selling at a loss! A manifest absurdity. The sale is not made at a loss, but at a profit; the apparent loss arises from attempting to attribute a separate cost to a part of the whole supply, whereas it is only the whole output which can have a calculable cost.

Mr. Cowan contends that this fallacy lies at the root of the "equal profit" or "maximum demand" system, and that unless it can be shown that the conception of the business described above is wrong, the whole system must collapse as being founded upon an unreality.

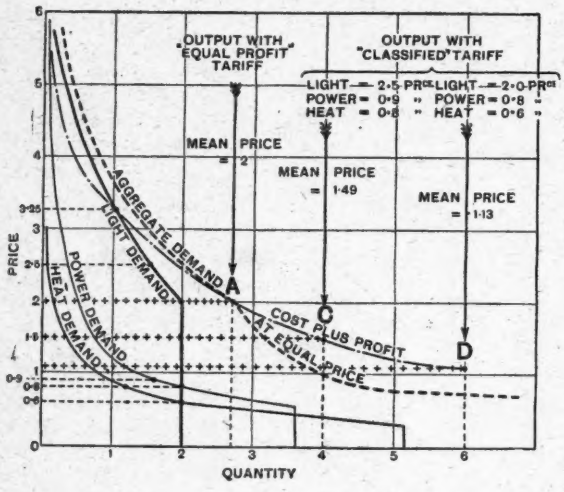
At the same time, entirely to ignore the conception of a separate cost to each unit produced, would be as wrong as to attribute a definite separate cost to each unit. Relative cost of supplying each consumer can be approximately arrived at. The method of analysis unfolded with such great precision by Mr. Arthur Wright is extremely useful, and, indeed, indispensable, to any manager who would know his business. By its means he can always arrive at an approximate idea of the relative value of each consumer to the undertaking. Such approximate ideas afford him general guidance, which enables him to direct supply into the most profitable channels, and thus add to the well-being of the community. The "classification" principle is not intended to replace the "maximum demand" principle, but to supplement it by submitting it to the modifying influence of another factor.

In order to make it clear to his audience of economists that he is not "tilting at windmills," Mr. Cowan quotes many leading electrical engineers who have from time to time advocated the rigid application of the "equal profit" or "maximum demand" system and condemned any departure from it as necessarily involving penalising some consumers in order that others may be subsidised.

Diagram No. 2, taken from the paper, we reproduce on the next page. In this diagram Mr. Cowan has endeavoured to isolate and depict the principle he is labouring to establish.

The relation between demand and price in regard to the three uses of electricity, viz., light, power and heat, are shown by three characteristics under the hypothetical conditions of a given area of supply. A fourth characteristic represents the relation between cost per unit of production and output. The aggregate of the three classes of demand at equal price (or equal profit) is shown dotted black. Where this curve touches the cost (plus a fixed percentage of profit) curve, the best results obtainable under the "equal profit" system are shown, which in this diagram are 2 price and 2·7 output. The effect of two scales of "classified" tariffs

is then shown. One of these scales (Lighting Price = 2, Power Price = 0·8 and Heating Price = 0·6), results in increasing the output from 2·7 to 6, and decreasing the mean price from 2 to 1·13, with the same percentage of profit. As in the arithmetical example given above, there is no penalising any class of consumer in order to subsidise others. The advantage gained is a specific gain due to the system; the price is not raised to the lighting consumers, and yet all the power consumers and all the heating consumers obtain their supply at a price considerably *below mean cost!*



The paper includes some warnings of pitfalls which may lead to disaster unless the system of "classification" is wisely administered. In the first place, it is open to abuse by, under cover of the system, giving personal preference, a pernicious practice, universally condemned. It also opens the door to error in estimating the probable course of demand in respect to any particular use of electricity. It is, however, contended that to reject a system because its use might be abused, or because its operation involved risks, would be an unworthy course to take. Abuse can be prevented by proper regulation and control, and risk of loss due to error minimised by providing a margin in the estimates of demand. As in most undertakings, the attempt to reduce business to a process of mechanically grinding out equal percentages of profit upon all operations, renders the obtaining of the maximum aggregate advantage to producers and consumers impossible. Some stability must be sacrificed in order to reach the higher planes of successful undertaking.

The system is also open to the criticism that though really equitable, it must appear to the ordinary consumer, who cannot be expected to regard the matter from any other than a superficial point of view, to be an unfair system. But the same system has been accepted in the transport of goods by sea and land. There have been many agitations; and legislation, prohibiting classification of transport rates, has been passed—and repealed. Nevertheless, "classification" has prevailed in the railway and shipping world. The commodity or service "transportation" for equal distance is sold at rates which are widely different for consignments of the same weight and measurement, which factors practically determine cost.

One other point: Is the system legal? This point is discussed in an appendix to the paper. Mr. Cowan has consulted Mr. Sydney Morse on the point, and he has expressed the opinion that "classification" is not illegal.

The plea for uniformity of system which is so often put forward, can, if the system of "classification" be adopted, only be realised in the form of "adapting rates to local conditions" in every case.

The paper concludes with a reference to the existing large potential demand for electrical energy for power and heating use, and regret is expressed that a possible means of meeting a larger part of this demand by adapting supply, through price classification, to its character and strength, is taken out of the hands of undertakers by their adherence to a principle which is scientifically unsound.

In the foregoing article a contributor has summarised Mr. Cowan's paper. The following are our own notes on the paper and discussion:—

The author thinks that the cost of production is not the only, nor even the chief, consideration which should govern the selling price of an article. He has reached this conclusion by thinking and working at the subject from a totally different standpoint from that of the engineer of an electricity undertaking, and, of course, as the title of his paper implies, electricity is the article to which he applies this reasoning. The term "engineer" is used, as is general, in the sense of the head officer, the guide and director of policy, of an electricity supply authority, and it may be remarked in passing that it is a great pity that there is only the one word in the English language to signify this man of wide ability and power, and the fitter who works with his hands at the construction or erection of a steam plant.

Naturally, as Mr. Cowan is not a central station engineer, he has to judge of what is being thought and done in the supply world from the utterances of those who make a habit of expressing views on the subject from time to time. He quotes many authorities in his paper who have written and spoken on the matter, including the late Dr. John Hopkinson, Mr. Arthur Wright, Mr. Wordingham, Mr. Snell, Mr. Yerbury, Mr. Pearce, Messrs. Handcock and Dykes, Mr. Woodhouse, and others.

From the data in his possession, he judges that central station engineers think that the price at which electricity is sold must be always and entirely determined by the cost of production. This was once true, but the many and various papers and speeches delivered lately by those interested in this ever-fascinating and most important subject seem to show, and the practice of suppliers in various towns and districts seems to show still more, that the character of the demand influences the selling price very considerably. The discussion which followed the paper, in which Mr. Pearce, of Manchester; Mr. Woodhouse, of the Yorkshire Power Co.; Mr. Watson, of Bury; Mr. Cridge, of Sheffield; and Prof. W. J. Ashley took part, tended to show that it is nowadays considered sound policy to charge classified tariffs based upon many considerations. Mr. Cowan used the expression "intensity of demand." Several speakers inquired for some elucidation of its meaning, and owing to the fact that—as is always the case—the time for discussion was extremely limited, Mr. Cowan was unable to reply at sufficient length. Perhaps we may venture upon an interpretation. Does it not mean a measure of the wish, of the vehemence of the desire, for a certain thing? People must and will have light, so they will pay more for it than for power and heat, which they can make for themselves in other ways—power by steam, gas, petrol, or water, heat by coal or gas.

The possibility or otherwise of estimating with accuracy the cost of units sold for a particular purpose has been discussed in great detail. Many have thought, and more have talked, about it. Views, sound and unsound, have been put forward, and it may be hoped that some day we shall arrive at an ideal.

In Alsace and Lorraine, about 40 years ago, the system was tried on the State Railways of making a fixed charge for terminal expenses and afterwards charging an equal rate per ton-mile on all goods transported. It was soon found that an exception had to be made in the case of coal.

The maximum-demand system makes a high charge for the first hour's use of the supply per day, and a uniform low charge for the remaining hours. The system was based upon—dare we say "Wright"?—principles, and whenever it is mentioned, applause is murmured. It is looked upon by many as an ideal, but how numerous are the exceptions to its complete operation! Sometimes time-switches are put in to cut out the indicator, except during the peak load period. Sometimes the indicator is cut out all the summer. Sometimes, if the consumer wishes to give a party, and to use all his lights, and perhaps to install more for temporary decorative purposes, the suppliers will cut it out one day in a month. It is put forward as a virtue on the part of the instrument that if the user turns on a few extra lights for a minute or two, it is so sluggish that no record is made. Those who applaud the system do not seem to grasp the fact that these little concessions,

which exactly typify the concession to coal mentioned above, knock the bottom out of the system! The maximum demand is the maximum demand, whether it occurs at 6 a.m. or 6 p.m., whether it lasts for 24 hours or 24 seconds. If notice is to be taken of all the points which crop up, the system becomes, not the maximum demand system, but a classified tariff. Everyone admits that the line of thought is right, but beyond that not many will go. The supply engineer will apply the principles of the system to his work, but he will not put in demand indicators. Of course, this is a general statement; we know quite well that several stations use the system, indicators and all, but there are nearly always alternatives.

Mr. Woodhouse summed up his views by saying that there were two limits between which the price must lie, the lower being the extra cost involved in generating the extra units required, and the upper being whatever one could get from the user. Mr. Cowan pointed out that there is the juristic and ethical principle to be considered, that the price must not exceed what the consumer could make it for if he had his own plant, and we would add that it must not exceed what he would have to pay for a suitable competitive commodity.

Mr. Pearce thought that it might be allowable to remit some of the charges on old capital to new consumers. In this he differed from Mr. Yerbury, who, in replying to the discussion on his historic paper of last year, said that it was extremely unfair that those who, by supporting the undertaking in its early stages, had borne the burden and heat of the day, should see all the benefit to which they had contributed given to new consumers. We think this is where Mr. Cowan's "intensity of demand" comes in to rectify matters. It should be remembered that the labourers in the vineyard who had worked all day only got a penny, as the others who came later did, and one inference is that the man who bears the burden and heat of the day is a fool for his pains, who ought to be very thankful that the burden was no heavier and the heat no greater than it was.

Prof. W. J. Ashley, who spoke as a layman, wondered that the principle of charging "what the traffic will fetch," should ever have been in dispute among electrical men. If you do not do that, therefore you do not get the demand, therefore you do not get the traffic, therefore you do not get the benefit of the reduction in expenses which accrues over the whole business. As an economist, he thought that the principles underlying the paper were sound. Selling price must be based on demand as much as on cost.

We are sorry Mr. Cowan's paper is written in such a stiff and difficult style. One specimen must suffice, "A closer approximation of correspondence between the incidence of supply and the incidence of demand is obtained than would be possible if the component parts of the joint product were priced so that each contributed an equal percentage of profit when bearing its proportionate share of the expenses of production." What can be done with a sentence like that? And the paper swarms with such—stopless, breathless, stickily-worded, nightmare-like. Mr. Cowan speaks and talks with much greater facility than he writes.

The paper, nevertheless, is an important contribution to thought on the subject. The question of the price of electricity is really too vital to be settled by experts, who too often cannot see the wood for the trees. When men like Mr. Cowan and Prof. Ashley agree with the policy and the conclusions of the experts, represented by those who spoke in the discussion and by many other central station engineers, we may feel reasonably sure that, after all, if we are not perfect now, we are at any rate moving in the right direction.

Combustion.

While the engineers were discussing at Sheffield on Friday morning last, in sedate and sober fashion, such as becomes the Scotch accent, their third report on "Gaseous Explosions," the members of Sections A and B were engaged in a spirited and lively discussion in another place upon the kindred subject of "Combustion," and one was privileged to see grave and learned gentlemen like Sir J. J. Thomson, Sir William Ramsey, Sir Philip Magnus and lesser lights of the B.A. world of physics and chemistry, disporting themselves with the abandon of undergraduates at a political meeting. As all of us are small workshops in which the phenomenon of combustion is going on every minute and hour of the day, no excuse is needed for dealing with the discussion in the columns of the Electrical Review.

The trouble arose in this way. The chemists have for years been working upon the problems presented by the combustion of hydrogen and carbon (either alone or combined) in an atmosphere of oxygen, and Prof. Bone, F.R.S., of the Yorkshire College, Leeds, who has carried out much important work on the subject, had prepared a most instructive and valuable report, summarising the researches of the past quarter of a century, which were classified under the following headings:—

Section I.—Ignition Temperature and the Initial Phases of Gaseous Explosion. Section II.—The Explosion Wave. Section III.—The Pressure Produced in Gaseous Explosion. Section IV.—The Influence of Moisture upon Combustion. Section V.—The Combustion of Hydro-carbons. Section VI.—The Influence of Hot Surfaces upon Combustion.

The investigations of Dixon, Mallard, Le Chatelier, Chapman and Baker, and the still later work of Prof. Bone and his pupils at Leeds, were referred to in detail in the pages of this report, and it was shown how enormously changed our views are with regard to the phenomena of *combustion*, as compared with those held 30 years ago. *Then*, combustion was regarded as a simple chemical change, in which hydrogen and carbon combined with oxygen to form water and carbon mon-oxide or dioxide gas, the hydrogen having selective action when the hydrogen and carbon were present together. To-day the chemistry of combustion is known to be one of the most intricate and remarkable branches of molecular activity, in which catalytic action, gas films, ions, and electrons, all play an important *rôle*. As Prof. Smithells well said in the course of the discussion, the chemist is up against a stone wall, and "catalytic" action is only another name for his ignorance of what is occurring when oxygen declines to combine with hydrogen or carbon, save in the presence of an infinitesimal amount of water vapour. The chemist has, in fact, reached the end of his resources, as regards the explanation of the phenomena now found to be concealed by every union of oxygen with carbon and hydrogen, and the physicist must be called upon to explain the effects due to the presence of third substances, if only in infinitesimal amounts, and to the action of gas films and heated surfaces, in starting or accelerating combustion processes.

So far all had been peaceful and quiet—and it was only when Sir J. J. Thomson rose to open the discussion, that symptoms of cerebral heating and disturbance became manifest, especially on the platform, where Prof. Armstrong, of London, occupied the chair. The noted Cambridge physicist had been appealed to by the chemists to explain the action of water vapour in starting or accelerating combustion, and it was but natural that he, being the author of the electron theory, should suggest as the cause of the phenomenon the presence and action of smaller and more rapidly moving particles than either atoms or molecules. Dealing with Prof. Dixon's well-known explosion experiments, Sir J. J. Thomson's view appeared to be that these smaller particles might be emitted and move forward in front of the wave, preparing the gas beyond for the explosion. In order to test the truth of this hypothesis, he suggested that Prof. Dixon should repeat his explosion wave experiment, using a transverse magnetic field to stop the advance guard (if such there was) of electrons—and should note if any difference was then observed in the rate of propagation of the explosion. Prof. Dixon, who was present and joined in the discussion, stated that he had already made some tentative experiments in this direction, but that he would repeat the same, using more elaborate apparatus and precautions. Sir J. J. Thomson's other contribution to the discussion of the subject related to the action of heated surfaces—in prompting combustion—which subject has been dealt with at some length by Prof. Bone, in presenting his report. Here undoubtedly gas films were present, for physicists believed all heated surfaces to be coated with positively or negatively-charged gas layers; and these layers would immensely affect combustion phenomena. The

nature or sign of the electrification was important in determining the effect, whether accelerating or retarding, upon combustion. Not only metals like silver, but such substances as lime and barytes, emitted a great stream of negatively electrified particles when heated; and these would have an immensely accelerating effect upon combustion. What was the origin of this stream of energy remained to be discovered. Possibly it would be found in an alteration between higher and lower forms of oxide, which varied with the temperature.

This was illuminating and suggestive, but not pleasing to the chemists who still believed in atoms and molecules as the ultimate basis of chemical reactions, and had an innate dislike to and disbelief in such modern inventions as "ions," "electrons" and "streams of negatively-charged particles," for the explanation of chemical phenomena. To suggest electronic action as the cause of combustion, was too much for the champion of the older school of thought, and it only required a little skilful manœuvring upon the part of Profs. Dixon and Smithells, to get Prof. Armstrong on his feet declaring with choleric mein, that chemical action only occurred in presence of electrolytes, and that electricity could only be forced through a sample of dirty water. Then came the exciting moment of the discussion, with Thomson, Smithells, Ramsay and Dixon all badgering Armstrong to explain exactly what he meant by an "electrolyte," and shouting flat contradictions at him when he asserted that pure water could not be made to carry a current. It was not exactly good manners, but it was very human—and how they and the audience all enjoyed it!

The practical engineer may read this and feel that the discussion has not advanced matters much, and that the efficiency of his furnaces or boilers is not going to be greatly increased by the "electron" theory of accelerated combustion. But this view may be premature, and it would be wiser for him, like the politician, to possess his soul in patience, and "to wait and see" what happens in another place.

If gas films negatively charged *do* accelerate the combustion process, and if certain substances when heated do emit streams of negatively charged particles which prepare the path for the explosive wave, we may be on the eve of some startling developments in the application of these laws to the combustion of fuel. Prof. Bone himself is now engaged with the practical developments of a new heating process which is of considerable interest to engineers, and will be made public at a later date.

And, whether results of practical value follow from the discussion or not, it was an intellectual treat to those who were present, and a revelation of the human nature which lurks even under the polished manner and reserve of our most noted scientists. "Bear-baiting" is an ancient sport, which is still practised occasionally, even in scientific circles, and by the British Association.

SOME RECENT ELECTPICAL PATENT CASES.

The fact that electrical invention is by no means dormant in England is fully borne out by a glance at some recent numbers of the Patent Office Reports. These Reports are published under the ægis of the Patent Office; and their careful perusal leaves upon the mind a very faithful impression of what is of immediate importance to persons concerned with English patent law.

It is probably the experience of English manufacturers that, for every 100 inventions which are made the subject of a patent, only a very few are of any commercial value. Those which are most successful nearly always figure in the Law Courts sooner or later. Those who infringe do not trouble themselves about valueless patents. Consequently, if we make a study of cases in which questions of infringement have arisen, a fair idea is gained of those patents which are, at the time, of general interest.

It is proposed in the present article to explain a few of he cases which have recently come before the Courts in relation to patents and inventions connected with electricity.

The first case to which we have to refer is Holmes *v.* Associated Newspapers, Ltd. (27 Patent Office Reports, 136), which illustrates the way in which the rights of an English inventor may be forestalled by a prior publication in America. It appeared that, in 1898, a patent was granted for "an improved system and means for driving newspaper printing or like machines, at variable speeds by electric motors." The claim was for "A system or method of electrically driving a newspaper printing machine or the like at very diverse speeds, consisting in the use of an auxiliary motor, in addition to and driving by power gear through the shaft of a main motor, both for the purpose of driving the printing machine at a slow and steady rate when required, and for starting the machine from rest, to enable the main motor to gather up power and drive without shock or excessive current, substantially as described." Claim 2 is a follows: "In an electrical driving device, a main motor, coupled or geared direct to the main shaft of a driven machine, in combination with an auxiliary light motor, power-geared to the shaft of the main motor, and a self-releasing clutch between auxiliary motor and main motor shaft, disengaging and cutting out the auxiliary motor, so soon as the main motor over-runs the latter, substantially as described." In an action for infringement the defendants alleged that shortly before the date of the patent there had been published in this country two accounts of an installation in the United States of America in which an auxiliary motor had been used with a main motor for driving a printing press. The motors were geared to the press in parallel, not, as in the plaintiff's system, in series. It was held at the trial that the first claim was not confined to the use of an auxiliary motor, in addition to, and driving by power gear through the shaft of, a main motor for the purposes mentioned in the claim in connection with the plaintiff's controlling device alone, but in connection with any suitable electrical device for operating the motors; that the fact that the motors were arranged in series in the one case and in parallel in the other was immaterial; and that there had been a prior publication rendering the patent invalid. The action was dismissed with costs.

The next case (British Westinghouse Electric and Manufacturing Co. *v.* Braulik 27 R.P.C. 290) raised an interesting question with regard to an arc lamp, the advantage of the type of lamp being that the arc between the two carbons was practically horizontal, and that there was no downward shadow. It appeared that a patent was granted in 1902 for "Improvements in electric arc lamps." It related to lamps of the class known as flame arc lamps. The claim was for "An arc lamp having downwardly pointing electrodes and provided with both downward and horizontal feed mechanism, so arranged that a certain amount of operation of the horizontal feed takes place before the downward feed mechanism is permitted to operate, subject to the disclaiming note." The disclaiming note was as follows: "The lamps to which this my invention applies are of the type in which the current is supplied to the electrodes through electrode holders in which the upper ends of the electrodes are firmly clipped, and which are capable of being lowered simultaneously through the same distance, and about one of which the corresponding electrode can swing under the action of a device acting near its lower end, and I limit my claim to lamps of this description." In an action for infringement of the patent, it was alleged by the defendant that the patent was invalid on various grounds, including disconformity and prior grant, but the only objections seriously contested were novelty and subject matter, and in support of these several specifications were alleged as a prior publication.

It was held, by the Court of Appeal, that the patent was valid, and had been infringed. The appeal was allowed, with costs. The whole point of the case is thus tersely summed up in the judgment of Lord Justice Fletcher Moulton, who is regarded as the leading authority on English Patent Law. Dealing with carbon electrodes, he said:—"Formerly the aim was to make them of the very purest carbon, so that they would be consumed evenly, and present no irregularities of constitution which would affect the steadiness of the arc. But it has been known for several years past that the presence of other elements in the arc—especially fluorine and chlorine—greatly increases its illuminating power. They permit it to be considerably longer than when carbon alone is used. In spite of all the

care with which electrodes are made, these composite electrodes present greater irregularities than those of pure carbon, and this, combined with the extra length of the arc, renders it at once more difficult and more important to have a mechanism in the lamp capable of instantaneously adjusting the electrodes so as to compensate for these irregularities and keep the light steady. The patentee claims that the mechanism, shown and claimed in the specification, has been the solution of this problem, inasmuch as his lamp promptly adjusts itself to the changes of resistance in the arc which accompanies these fluctuations, and that it is by the use of this invention that horizontal 'flame' lamps—as such lamps are called—have come into practical use in this country. I am of opinion that this contention of the plaintiffs is justified by the evidence."

Another case ("Z" Electric Lamp Manufacturing Co., Ltd., *v.* Marples, 27 R.P.C., 305) related to an important improvement in the manufacture of metallic-filament lamps, which have come into very general use in England. In that case the owners of letters patent for "Improvements in the manufacture of filaments for incandescent electric lamps" having brought an action for infringement, the defendants pleaded that the specification was misleading and insufficient, and that the invention was not useful, and they denied infringement. The invention related to metallic-filaments, and the specification stated that it provided means for removing even the last traces of carbon from the filaments, and that it consisted in effecting the decarbonisation of the filaments by means of gases produced in vacuo by heating phosphorus compounds containing hydrogen and nitrogen, and also optionally containing oxygen or sulphur, such, for example, as (*inter alia*) phospham, phosphoramide, with the addition of phosphorus, if necessary. The specification stated that phospham was specially suited because not only was the nitrogen contained therein released in vacuo from its combination even at a comparatively low temperature, and when set free formed with the carbon, or other similar, or oxidised, carbon compounds, but also the phosphorus which was set free was capable of performing certain functions therein mentioned. The defendants alleged that phospham and phosphoramide, and the other compounds named in the specification, did not act on the carbon in the filaments in the manner therein alleged, and that phospham was not capable of removing carbon from a tungsten filament in any of the ways described, and they gave particulars of the insufficiency of directions alleged. In the defendants' process of manufacture the filaments, which were made of tungsten, and in the earlier stage of manufacture contained carbon, were flashed or "sintered" in the presence of ammonia, and the defendants alleged that thereby practically all carbon was removed from their filaments, and that, although they introduced a mixture of phospham and red phosphorus into the bulb of the lamp, yet they did this for a different purpose, and that in fact no carbon was removed, and that as to the claim alleged to be infringed it was limited by the words "for the removal of carbon." It appeared at the trial that the presence of carbon was disadvantageous in filaments for several reasons, and that at the date of the patent the blackening of the glass bulb was commonly supposed to be deposited carbon; subsequent knowledge proved, however, that it was not carbon, but that the blackening was in some way due to the presence of carbon, and that the use of phospham did in fact prevent blackening. A great deal of the evidence at the trial was directed to the meaning of phospham, which had been the subject of scientific papers, and was, at the date of the patent, included in the catalogue of a German firm of manufacturing chemists known in this country. It appeared from the evidence that the invention would work using phospham which had been exposed to moisture, but that ammonia, not nitrogen by itself, was released and formed a compound with the carbon. The defendants alleged that phospham had the formula PN_2H, and that, with this, the reaction stated in the specification could not be obtained.

It was held that the specification was addressed to the manufacturer of incandescent lamps and not to the chemist; and that, if it contained errors in chemistry, they were unimportant except to the extent to which they might mislead the lamp manufacturer; that phospham if it were allowed to absorb moisture would produce phosphamide, and would on heating give off ammonia; that it was impossible to get pure phospham PN_2H, and that under these circumstances the specification was not misleading; also that the directions were not insufficient; that the invention was useful; that the patent was valid; and that the defendants had used the process on filaments containing carbon, that the process normally operated to remove carbon, and that the defendants had infringed. An injunction was granted, and an inquiry as to damages, with delivery up of infringing articles.

The last case to which we have to refer illustrates a well-known principle of English patent law—namely, that while a patent may be obtained for a combination of old ideas, there must be some novelty in the combination, otherwise the patent is invalid. In Donnersmarckhutte Oberschlesische Eisen-Und Kohlenwerke Actien Gesellschaft *v.* Electric Construction Co., Ltd. (27 R.P.C. 321), it appeared that a patent was granted for "improvements in means for the control of electrically-driven reversible rolling mills." The claim was for the arrangement, described in the specification, for regulating the velocity of the mills without the use of switched-in resistance, and for effecting a gradual demand for current from the main source, so that the demand did not rise to the full amount of consumption corresponding to the work required by the mill motor on starting, consisting of a mill motor driven by a current from a motor dynamo driven directly from the main current source and provided with flying masses, the electromotive force transmitted to the mill motor being regulated by alteration of the field-magnet excitation of the dynamo part of the motor dynamo that generated the current for the mill motor. In an action for infringement of the patent it was proved that, in 1891, Leonard had published descriptions of a method by which a motor subject to a variable load could be controlled, and the demand on the source of supply could be kept constant. Also, in 1895, a description had been published in the specification of Ferranti, of a means of working tramways and lifts, consisting in the use of an intermediate motor and dynamo with a fly-wheel on their shaft, the motor being of a type that would slow up with an increase of load. The defendants contended that the patentee had merely put together the systems of Leonard and Ferranti without invention; or had adapted the system of Leonard with the addition of the common expedient of a fly-wheel. The alleged infringement consisted of the system of Leonard with a fly-wheel on the intermediate dynamo, but the speed drop of the intermediate motor was secured not as in the plaintiffs' system, by its winding, but by means of an automatic regulator in its field circuit.

Mr. Justice Parker held that if the patent was valid, the defendants had infringed, but that the patentee had made a combination of old elements, that each member of the combination gave its own result, and there was no result that flowed from the combination itself; and that the patent was invalid for want of subject-matter. The action for infringement was dismissed, with costs.

LEGAL.

Feld Bros. & Co., Ltd., *v.* Pinkerton.

In the City of London Court on the 1st inst., before his Honour Judge Lumley Smith, K.C., a claim was made by Feld Bros. & Co., Ltd., electricians, against Mr. G. M. Pinkerton, ironmonger, 5, Lloyd's Avenue, E.C., for £37 6s. for Osram and other metal-filament lamps supplied. Mr. Fichtenmann, for the plaintiffs, said that the General Electric Co. would not take Osram lamps back unless they were returned within eight days of the delivery. Judge Lumley Smith thought that was unreasonable; it was not long enough for a proper test to be made by the defendant's customers. Mr. Fichtenmann said that the defendants had kept the lamps complained of for five months, and that was wholly unreasonable. Judge Lumley Smith found for the plaintiffs for £30 and costs, plaintiffs to take back the broken lamps, and to fetch them.

BUSINESS NOTES.

Patent Restoration.—Application has been made by Aktiebolaget L. M. Ericsson & Co. for the restoration of the patent granted to Kjöbenhavns Telefon-Aktieselskab for "Improved apparatus for the automatic distribution of the operating service in telephone exchanges." (No. 14,851 of 1906, which expired on June 30th, 1909, owing to non-payment of renewal fee.) Opposition to the restoration should be lodged at the Patent Office by October 31st

Private Meeting. — Accessories Manufacturing Co., Ltd., 11, Dean Street, Soho, London, W., electricians, &c.—A meeting of the creditors of the above was held on Friday last at the offices of Messrs. H. B. Brandon & Co., chartered accountants, 36, King Street, E.C., Mr. H. A. McCann (the voluntary liquidator) presiding. A statement of affairs was presented showing gross liabilities amounting to £5,960, of which £2,728 was owing in respect of first debentures, and interest, whilst an amount of £862 was due in respect of second debentures and interest. The indebtedness to the trade was £1,552, and there were also cash creditors for £817. The assets were estimated to realise £2,212, less £78 for the claims of preference creditors, leaving net assets £2,134. The assets were as follows: Cash in hand, 10s. 11d.; book debts, £824 6s. 3d., estimated to produce £460; stock at cost, £1,632; catalogues, £20, and fixtures and fittings, £100. Mr. McCann stated that the company was formed in April, 1905, to take over the business which had previously been carried on by Mr. Ralph Ball, under the style of the Accessories Manufacturing Co. At the time the company was formed the first debentures were issued. Debentures of £1,500 were issued in respect of moneys previously advanced to the business by Mr. A. K. Ball, and that gentleman at the same time advanced a further sum of £1,000 in cash. That made up the total sum of £2,500 owing on the debentures, which were still held by Mr. A. K. Ball. Towards the end of 1906 it was found necessary to get more money for the company, and this was obtained by the issue of the second debentures for £800. The holders of the second debentures were Miss Douglas, £500; and Mr. Ibbertson, of Leeds, £300. The company continued trading, but it was not a success, and in 1908 Mr. R. Ball resigned. Since that time the business had been under the direction of Mr. Douglas, who was now the managing director. In order to carry on the business, further money had been required, and at different times Mr. A. K. Ball had advanced amounts which totalled up to £800, for which he was now an unsecured creditor. At the end of July of the present year certain bills were becoming due, which the managing director found he could not meet. Further financial assistance was required, but the first debenture-holder then said that he could not give the company any more help. He (Mr. McCann) was then appointed to act as receiver on behalf of the debenture-holders. Following that step it became necessary for the company to go into liquidation, and he had been appointed voluntary liquidator of the company. In answer to a question, Mr. McCann said he was afraid that there was no prospect of the creditors receiving anything. In fact, there did not appear sufficient to even pay the first debenture-holders in full. In answer to further questions, the liquidator stated that the company was really a private flotation. The nominal capital was £5,000, of which £3,500 had been subscribed. According to the books, the business was quite solvent at the time the company was formed. Still, it was quite true to say that shortly after the formation of the company, the working capital consisted chiefly of the £1,000 obtained by means of the debentures. When the company was formed the liabilities amounted to £2,600, while the book debts and stock alone were in excess of £4,200. The present position was due to losses on trading. During the 18 months ended September, 1909, there was a loss of £1,074. The managing director of the company was a cash creditor for £120, this representing arrears of salary. After a short discussion, the creditors decided not to pass any resolution, and therefore Mr. McCann remains as the voluntary liquidator of the company. The following are creditors:—

Heath, Samuel & Sons, Ltd.	£350	Ickelheimer, M.	£32
Gilson, D., & Co.	167	Gaskell, Gorott & Co.	27
Douglas, J. M.	114	Guy & Co.	26
Zimmerman, P., & Co.	105	Brandon, H. B., & Co.	22
Macintyre & Co.	103	Schoen Bros.	21
Taylor, Tunnicliffe & Co.	94	Nettlefold & Sons	20
General Brass Fittings Co.	56	Goossens, E., Pope & Co.	16
Hawkins Bros. & Co.	53	Palmer, A., & Co.	16
Gogarten & Schmidt	37	Electrical Co., Ltd.	15
Owtram, C. W., & Co.	33		

There are also a number for smaller amounts.

Swedish Turbines.—With reference to Mr. Clayton's paper on "Hydro-Electric Installations in Sweden," which appeared in our issue of August 19th last., Messrs. Jens Orten-Bovving & Co. inform us that the turbines for all the plants illustrated were supplied by their Swedish works in Kristinehamn, the plants including:—Ringdalen—Four of 1,000 h.p., one of 600 h.p., and two of 200 h.p. Gullspang—Six of 5,000 h.p. Graninge—Four of 2,500 h.p. Avesta—Four of 500 h.p. Korsnäs—Two of 210 h.p. Other plants which they have supplied in Sweden, include:—Bullerfors—Three of 4,000 h.p., and two of 450 h.p. Sydsvenska Kraft A.B.—Eight of 1,900 h.p., and five of 110 h.p. Horndäls Näs—Eight of 600 h.p. Trolhattan—Two of 12,500 h.p.; and in Canada the plants which they are supplying include Calgary Power Co., two of 3,750 h.p., two of 330 h.p.; Winnipeg City, five of 5,200 h.p., and two of 450 h.p.; and Ocean Falls, six of 1,800 h.p. The total output of the Kristinehamn works now reaches some 300,000 h.p. in Francis turbines alone.

Book Notices.—We have received from the Key Engineering Co., Ltd., a copy of a pamphlet by Mr. Leonard Andrews, based upon an article by Dr. R. Drawe in *Stahl und Eisen*, in which the constructional details of the double-acting four-cycle gas engines made by Messrs. Ehrhardt & Sehmer are described. The subject is extremely interesting, as the evolution of each of the chief items of construction—the cylinder, piston, piston-rod, valve gear, &c.—is discussed in detail, and the methods adopted to eliminate the various defects revealed by experience in the earlier designs are clearly indicated, with numerous sectional drawings. These engines are being built in England by Messrs. Galloways, Ltd.

British-Made Goods and where to Get Them. London: Commercial Inteligence Bureau, Ltd.—This is a book which is issued gratis, for reference purposes, to the buying departments of Colonial and and foreign Governments, public institutions, Consular and other offices, and so forth. It claims to be a representative list of British goods whose manufacturers maintain active export departments. The goods are arranged alphabetically in three languages. In the first section the description of the manufacture is given with a reference number relating to Section II, where the name and other particulars of the firm making it appear in English, French and Spanish.

"*Bulletin* of Armour Institute of Technology." Vol. IV, No. 1. May, 1910. Chicago: The Institute.

"*Prospectus* of the Faculty of Engineering, University of Liverpool." 1910-1911. Liverpool: The University.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVI, No. 6. August, 1910. New York: The House of the Society.

"*Prospectus* of the Municipal School of Technology." Session 1910-1911. Manchester: The School. Price 6d.

"Relatorio apresentado ao Presidente da Republica dos Estados Unidos do Brazil pelo Ministro de Estado da Industria." Four vols. 1909. Rio de Janeiro: Imprensa Nacional.

"Boletim of the Minister of Industry." 1909. Rio de Janeiro: The Director of Statistics.

We have received a copy of an American monthly electrical journal, the *Southern Electrician*, which is published at Atlanta, Ga., and is, as its claim indicates, devoted to distribution of electrical equipment of supplies and telephone apparatus in the South. The August issue contains a number of interesting articles.

D.P. Storage Batteries.—The D.P. Battery Co., Ltd., of Bakewell, have just concluded contracts for the supply of their batteries to the District Councils of St. Annes-on-Sea and of Naas (Kildare), the Chorlton Board of Guardians, and for a number of private installations. The maintenance of these batteries for terms of years has been undertaken by the company. They have also secured orders for three batteries for South Africa for mining and other purposes. Specimen cells of their manufacture are being exhibited at the Buenos Ayres Exhibition by their agents, Messrs. Milne Makein y Cia. of that city. The company are wishful to appoint additional agencies in foreign countries where they are not already represented.

Trade Announcements.—The British Central Electrical Co. have removed from 17 to 84, Hatton Garden, E.C., where they have additional facilities for handling increasing business.

The Foster Arc Lamp and Engineering Co., Ltd., finding it necessary to considerably extend their works, have removed from Worple Road, Wimbledon, to Morden Road, Merton. The new works stand on 3½ acres of ground, and they contain every facility for giving prompt delivery; they are also to be further extended. The firm's "Q" type flame lamp has been selected for the illumination of the People's Palace, Mile End Road, Messrs. H. J. Cash and Co., of Caxton House, being the contractors. The Foster Co. have recently made large reductions in the price of carbons for these "Q" lamps.

Nuremberg Gas Engine Contracts.—The Maschinenfabrik Augsburg-Nurnberg A.G. has secured a contract for two Nuremberg gas engines, each of 3,200 b.h.p., to operate on coke-oven gas, from Messrs. Mitsui & Co., Japan. The Lilleshall Co., who are licencees in this country of the above engine, have supplied them to the Barrow Haematite Co., and have recently secured orders from the United Alkali Co., of Widnes, and Messrs. Albright and Wilson, of Oldbury, for large gas engine plants.

Installation Work.—Mr. Harry Moss, of Bradford, has been appointed electrical engineer and adviser to the Grassington Electric Supply Co., Ltd. The plant is a small water-power set installed last year by a firm for whom Mr. Moss was then manager. Mr. Moss also has the following contracts in hand:—24 street lamps, wiring and equipment, also the lighting of the Town Hall and public buildings, for the Grassington Parish Council; the laying of underground cable for street lighting for the Clayton West Council; the lighting of the Commercial Hotel, Grassington; and the lighting of a number of private residences and shops, as well as small mill installations, in and around Bradford.

Liquidation. — The Swansea Safety Fuse Co., Ltd.—This company is winding up voluntarily, with Mr. H. de Mosenthal, Winchester House, E.C., as liquidator, with a view to selling the business, property, &c.

Turbo-Pump Orders.—MESSRS. JENS ORTEN-BOVING AND CO. have recently booked a number of orders for "Victoria" turbo-pumps, of the automatic balancing type, including the following :—

One pump, to deliver 390 gallons per minute against 238 ft. head, for the Municipality of Delta, B.C.
One pump, to deliver 600 gallons per minute against 60 ft., for Messrs. Takata, Japan.
One pump, to deliver 125 gallons per minute against 196·5 ft. head, for the New Zealand Government Railways.
Two pumps, each to deliver 250 gallons per minute against 184 ft. head, for the Hydro-Electric Commission at Preston, Canada.

Water-turbine plant orders include—

One unit of 250 H.P. at 28 ft., for Soma Denki, Japan, through Messrs. Dick, Kerr & Co.
One of 28 H.P., for Messrs. J. Hardie, Glasgow.
One Böving patent oil pressure governor, for the Hachinohe Hydro-Electric Co., Japan.
One turbine of 165 H.P. at 165 ft., for the Motomiya Light Co., Japan, through Messrs. Dick, Kerr & Co.
One turbine of 135 H.P. at 61 ft. head, for Mr. Richards, South Falls, Canada.
Two turbines of 565 H.P. at 27 ft. head, complete with Böving patent governors, for Messrs. Rose & Holgate, Montreal, for the town of Farnham, Quebec.

Bankruptcy Proceedings.—WALTER LEE GRIMSLEY, electrician, Eureka Motor Works, Shelley Road, Boscombe, Bournemouth.—This debtor recently attended at the Town Hall, Poole, for his public examination on a deficiency of £200. It transpired that the debtor started in partnership with a Mr. E. Elkins, but the concern had never proved successful. The debtor was allowed to pass.

Austria.—THE OESTERREICHISCHE BROWN-BOVERI WERKE GESELLSCHAFT is the title of a new company which has just been formed in Vienna with a capital of 4,500,000 crowns, under the auspices of the Lower Austrian Discount Co., and Messrs. Brown, Boveri & Co., of Baden, Switzerland. The new concern will take over the works in Vienna of the Vereinigte Electricitäts Gesellschaft.

Catalogues and Lists.—THE ADNIL ELECTRIC CO., LTD., Artillery Lane, London, E.C.—Leaflet No. T 67, containing a full description with half-tones and line diagrams of Blut's patent burglar alarm, which the firm has just placed on the market. Price list No. 123 E, contains some 32 pages, giving particulars, weights, prices, &c., of N.F. direct-current dynamos (2·5 to 48 KW.), and motors (3 to 68 H.P.). Particulars are given also of motor-generators, spur reduction gear, metallic and liquid starters, flexible couplings, &c. The list opens with a detailed specification, and closes with very fully dimensioned sketches of the various machines dealt with, also with a list of code-words.

MR. C. FONTEYN, 83, Mortimer Street, Great Portland Street, London, W.—Several publications. One contains full information, together with a Faraday House report as well as particulars of tests made at Zurich, concerning "Pernisol" insulating varnishes for the electrical industries ; other leaflets describe respectively the A.M.T. automatic switch, transformers for metallic-filament lamps, and the "Iota" metallic-filament lamp, of all of which price particulars are given.

MESSRS. L. ANDREW & CO., 2, Whitworth Street West, Deansgate, Manchester.—Net wholesale price list of insulating tapes for electrical purposes, also a revised price list of Leclanché batteries.

MESSRS. GEORGE SCHULTZ & CO., Excelsior Works, Ravald Street, Salford, Manchester.—20-page pamphlet containing particulars as to prices of various electrical insulation materials supplied by Messrs. Meirowsky & Co., for whom they are agents.

MESSRS. KINGOLITE CO., 164, Wardour Street, London, W.—Priced leaflet with brief description and illustrations of the "Kingolite" patent electric candle fitting.

THE GLOBE ELECTRIC CO., LTD., 11, Farringdon Avenue, London, E.C.—We have received a copy of a hanging showcard, which is just issuing from the press, effectively showing the "Multax" long burning flame lamp. Electrical contractors, electricity supply authorities, and others interested, can have copies on application.

MESSRS. J. H. HOLMES & CO., Newcastle-on-Tyne.—12-page catalogue (August) containing description, excellent half-tone views, and tabulated particulars of speeds, voltages, code-words, prices, &c., of their new two-pole "Castle" "W" type motors and dynamos fitted with ball bearings.

THE WESTERN ELECTRIC CO., LTD., Norfolk House, Victoria Embankment, London, W.C.—Bulletin (No. 4,003) entitled "Western Interphones and Private Line Telephones." This is a 24-page pocket-size pamphlet containing illustrations and prices of, and information in concise form concerning, telephones and the necessary accessories specially suitable for private installations. It has been issued for the use of contractors and practical electricians. Copies of the bulletin can be furnished with contractor's own name and address printed thereon. Automatic replacement type instruments, new metal type central battery telephones, domestic telephones and cables, cells and other accessories, are included.

OHIO ELECTRIC WORKS, 6,304, Ellen Avenue, Cleveland, U.S.A.—Price list of small house lighting sets and electrical supplies.

MESSRS. W. GEIPEL & CO., 72A, St. Thomas Street, London, S.E.—New 1910 catalogue of motor-starters, motor panels, resistances and rheostats, open-type field rheostats, theatre dimmers, &c., containing particulars, illustrations, dimensions, prices and code words.

MESSRS. LOXLEY & CO., Cabinet Chambers, Basinghall Street, Leeds.—New circular illustrating the V.B. cleat ceiling rose and showing its advantages.

MESSRS. JOHN SPENCER, LTD., Globe Tube and Engineering Works, Wednesbury.—Eighty-page catalogue of their various iron and steel tube manufactures, pipe joints, stocks and dies, telegraph and telephone poles, steam fittings, &c. Prices are given in detail.

MESSRS. DRAKE & GORHAM, LTD., 66, Victoria Street, London, S.W.—Advance copy of a new trade catalogue, the different sections of which are indicated by a thumb index. The first section (incandescent lamps) consists of 24 pages of illustrations and prices of Osram, tantalum and carbon lamps, battery and radiator lamps, also shop window and photographic lamps. Section 2 (arc lamps) deals similarly, in eight pages, with "Butt" flame and "Excello" lamps, enclosed and photo lamps, contact gear and globes and carbons. Section 3 (eight pages) is devoted to cables and flexibles. Section 4 (28 pages) covers switchboards, switchgear, lighting accessories and bells. Section 5 (16 pages) shows electric heating and cooking apparatus (radiators, table heaters, hot water urns, irons, hot plates and ovens. Three small following parts deal with auto-transformers, two-part insulators and "D-G" continuity clips, and the last section of all consists of 60 pages of illustrations of various designs of counterweight fittings, brackets, electroliers, pendants, ceiling fittings, table standards, Holophane arcs, Phœnix outside lanterns, bulkhead fittings, fancy shades, and many associated lines. A good enamelled paper, bold printing, and a clear arrangement, combine to make at once a very presentable and business-like catalogue.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—New edition of their catalogue of various kinds of electric bells, indicators, pushes, contacts, wires, batteries, water level alarm apparatus, burglar alarm devices, lightning conductors, and so forth. The book consists of some 94 pages of illustrations, brief notes, and clearly indicated prices.

Rubber Exhibition.—We have received a pamphlet giving full advance information relating to the Second International Rubber and Allied Trades Exhibition which is to be held at the Royal Agricultural Hall, London, from June 24th to July 11th, 1911. The Exhibition offices are at 71, Chancery Lane, W.C., and full particulars can be obtained from the organising manager, Mr. A. S. Manders, at that address.

South Africa.—The *British and South African Export Gazette* reports as follows :—

It is proposed to form a company with a capital of £926,000 for the erection and working of an electricity generating station at Tweefontein.

Three schemes are under consideration for the electric lighting of Klerksdorp, the estimated cost of realisation being about £9,500.

It is proposed to spend £150,000 on the Cape Town docks to bring them up-to-date. If the expenditure is sanctioned, a powerful bucket dredger and an electric travelling crane will form part of the equipment.

Electrical Machinery, &c.—The order for the electrical equipment required for the new air-compressor station on the property of the New Modderfontein Gold Mining Co., Ltd., has been placed with the British Westinghouse Electric and Manufacturing Co., Ltd., and includes a number of 1,000-B.H.P. direct-coupled three-phase induction motors.

An order has been placed in England on behalf of the Benoni Municipality for a quantity of electrical material.

The A.E.G. Electrical Co. of South Africa, Ltd., have in hand an order for the supply of 88 direct-current electricity meters to the Johannesburg Municipality.

We learn that the Transvaal Gold Mining Estates, Ltd., are about to purchase a large power plant.

The Johannesburg Municipality have placed a contract with Messrs. Siemens Bros. & Co., Ltd., for the supply of 2,277 alternating-current electricity meters.

The contract for the supply of generators and compressors for the new power station at Rosherville, Transvaal, was secured by the Allgemeine Electricitäts-Gesellschaft.

Orders for a quantity of electrical material have just been placed with the makers on account of the South African Government Railways.

An order for a battery and "Entz" booster equipment has been placed with the Chloride Electrical Storage Co., Ltd., by the Delagoa Bay Port and Railway Council.

The Synchronome Co., London, recently secured contracts to install their system of electrical impulse dials in the Government offices, Pretoria, and the Transvaal University, Johannesburg.

A large electric plant was recently imported for the Utrecht colliery.

"Contractors' Column."—With reference to the item appearing in this section to-day under the heading of Middleton, our correspondent informs us that the address of Messrs. Pepler and Allen, architects, is 3, Pall Mall East, London, S.W., the office at Middleton being only temporary.

LIGHTING and POWER NOTES.

Aberdeen.—Mr. J. A. Bell, in his annual report to the Electricity Committee, states that one of the outstanding features of the year was the boom given to electrical heating by the hiring out of apparatus and the amended price for supply of this nature. Another feature was the reduction in price per unit charged for Corporation tramway supply. There are only four tramways in the kingdom getting supply at a lower figure than the Aberdeen tramways. Continuing, Mr. Bell says "the effect of the installation of the metallic-filament lamp is still apparent on our output ; but there are compensations, as we can now obtain a class of consumer impossible in the days of carbon-filament lamps. In our Deeside

districts, for instance, the smallest cottages are now regularly wired for electric light. The Aberdeen architects are, to a large extent, still installing gas for lighting purposes in small houses within the city, and I am inclined to think they neglect the fact that a thoroughly sound and satisfactory installation of electricity is as cheap to install—and, nowadays, practically as cheap, light for light—as gas, irrespective of the many incidental advantages which electricity can claim." Mr. Bell states that 181 new consumers were added during the year, and that motors representing 387 H.P. have been coupled up since the last report. The new scale of charges, he reports, has given satisfaction, and, with one exception, heating, should remain the same for another year. He recommends that the charge for heating purposes be reduced from 1½d. to 1d. per unit.

The Electricity Committee has approved of the accounts for 1909-10. It was shown that the total capital expenditure was £368,616. From the sale of current by meter during the year there was an increase of £1,350. In the amount received from the City and Suburban Tramways there was a decrease of £1,989, due to increased economy in consumption. The net revenue showed a surplus of £967, which has been carried to the reserve fund, which now amounts to £13,832.

Accrington.—The electricity department has acquired additional machinery to meet the extra demand entailed by the supply of energy to Haslingden and Church. The plant has been purchased at a sale by the Westminster Co. of its Millbank generating machinery. The engine house is to be enlarged to find room for the new plant, the cost of which is to be taken from the depreciation and renewals fund account. To supply electric current in bulk to Haslingden, Accrington will have to spend something like £9,687. Some £2,670 of the outlay will be within the borough of Haslingden, including four miles of mains, £1,200; the laying of the mains, £620; the rest being made up by the cost of transformers, switchgear, &c. Extra provision of buildings, mains, &c., in Accrington will absorb £9,687, of which £4,000 will be for buildings, and £2,000 for mains. To lay cables in Church will involve an expenditure of £1,002. The Corporation is now seeking powers to borrow £16,359 for the work.

The Council has received a communication from Oswaldtwistle Council asking on what terms the Corporation will supply electricity for power and lighting purposes; a sub-committee is to meet representatives of Oswaldtwistle Council on the matter.

Aldeburgh.—Messrs. Christy Bros. & Co., Ltd., of Chelmsford, have informed the T.C. that they are applying for a prov. order for electric supply.

Argentine.—The plans and estimates have been approved for equipping the Buenos Ayres Customs House with an electric installation, and for arranging for the work to be carried out at a cost of about £22,000.

Bath.—The B. of T. has informed the R.D.C. that as the Bath T.C. has now obtained a prov. order for E.L. in respect of a portion of the area of the R.D.C., it is proposed to revoke the Council's order with regard to the whole of the area of supply.

Bognor (Sussex).—At a meeting of the U.D.C. on Friday last, a notice was received from the Chichester E.L. Co. intimating that it intended applying for a prov. order for electric supply. The Council proposes to have a preliminary report upon the advisability of carrying out an E.L. scheme, prepared by an engineer.

Burnley.—The Electricity Committee has refused financial support to the promotion of a Bill as suggested by the Incorporated Municipal Electrical Association, but has agreed to ask the Borough member to support it if introduced.

The electricity department is going to lay at a cost of £1,800 a cable to the centre of Brierfield in order to enable the Corporation to supply electricity for working the tramways in Brierfield. The department is also extending its lighting cable along Briercliffe Road, in which tramways are at present being constructed.

Cleveland.—A 10,000-H.P. rolling mill motor, to which we have previously referred, was tested at Messrs. Siemens's Stafford works on August 31st. The motor is for the Skinningrove Iron Co.

Continental Notes.—SWEDEN.—The lack of supplies of coal in Sweden has induced engineers and iron and steel producers to devote special attention for years past to the question of the electrical smelting of iron ore, as, if it is found commercially possible to undertake this work, hopes are entertained of the extension of the local iron and steel industry on a large scale, instead of exporting the majority of the production of iron ore every year. Since 1906 experiments have been made with an electric smelting furnace at the Domnarfret Works, which belong to the Stora Kopparsbergs Bergslag Aktiebolag. It is said that the trials have now led to practical success. A new ironworks is to be started this year, and 10 other works are also proposed for the smelting of ore according to Lindblad's electrical process. About 4,000 H.P. will be required for each works. The new power station near Bullerfonen supplies 24,000 H.P., and a second power station will probably soon be erected at Forshufond. The exports of Swedish ore are already limited by the Government, which has also assisted in another way to promote a reasonable utilisation of the deposits. Thus the Parliament in the present year has passed a Bill whereby an electric power station is to be erected near the Porjus Falls, in the Lule River, 31 miles to the south of Gellivare. By this means it is proposed in the first place to convert to electric traction the railway section between Kiruna and Riksgransen, and trains having loads of 2,000 tons of ore will be hauled along the line. There will still remain available a large amount of power, which will be of considerable importance if the attempts to smelt ore by electricity which are now in progress at the State power station at Trollhatten should prove to be favourable.

GERMANY.—The Alba Braunkohlenwerke Gesellschaft is putting down an electrical generating plant at its collieries at Kleinsauberitz, near Baruth, Saxony, and will transmit the electrical energy generated to the town of Lobau for lighting and power purposes.

The municipal central electric lighting station at Bremerhaven is to be extended at a cost of £17,500.

Dublin.—Mr. Mark Ruddle, in his quarterly report on the working of the electricity department, says that owing to the increase in the load it will be necessary to increase the capacity of nine of the old sub-stations. Certain transformers will be transferred, and eight new 100-KW. transformers with two spares, and four new 50-KW. ones will be required.

Fleetwood.—Notification has been received that the L.G.B. has sanctioned the borrowing of money for the electricity works extension at Fleetwood. The contractors, Messrs. T. Riley, Ltd., hope to have their portion of the work completed before long, so that there will only remain the machinery to be installed.

Glasgow.—The annual accounts and balance-sheet of the T.C.'s electricity department for the year have been issued, and show that the gross revenue amounts to £245,959, and the working expenditure to £105,438, leaving a balance of £140,521, out of which the Committee had to meet the following statutory requirements: (1) Interest on loans, £57,381; (2) sinking fund, £39,475, leaving a balance on the year's working of £43,665. Depreciation written off capital account, which, together with the contribution to the sinking fund, is equal to a rate of fully 4 per cent. upon the gross capital expenditure, amounts to £43,474, leaving a surplus on the year's operations of £190. Last year there was a deficit balance of £3,544. The reserve account now amounts to £20,131. The total capital expenditure, less depreciation written off, stands at £1,853,434. During the year there were sold to private consumers 34,742,853 units, compared with 32,736,058 units in the previous year, an increase of 6·13 per cent. The number of consumers at the end of the financial year was 19,489, an increase of 1,331 or 7·33 per cent. The total number of motors supplied off the Corporation mains was 4,851, with a total H.P. of 32,918, compared with 4,292 and 29,505 H.P., while the number of units consumed for power purposes was 19,438,936; there are 837 arc lamps, and 24 incandescent lamps have been added, the total quantity of electricity consumed for street and store lighting being 1,736,390 units, against 1,728,853 units. The number of 8-C.P. or equivalent lamps connected to the mains was 1,759,120, an increase of 121,933, and the average units consumed by private consumers were 20·63, compared with 21·17. The maximum load upon the generating stations during the year occurred on December 16th last, when it was for 21,719 KW.

In his annual report on the plant of the electricity department, the engineer (Mr. W. W. Lackie) states that the extension to the boiler house at Port Dundas station has now been completed, and the new stores are in use. It was now possible to store 7,000 tons of coal, which would keep the works going for a considerable period in the event of a strike or other contingency. The station contained plant aggregating 28,000 H.P. At Pollockshaws Road station, fans had been fitted to another of the large cooling towers, and these had considerably increased the capacity of the tower. One 1,000-KW. motor-generator had been erected at Springburn sub-station. In addition to the sub-stations, seven large consumers were being supplied through transforming plant, equal to 4,000 H.P., on their premises.

Grassington.—The Parish Council has placed the contract for the whole of the street and Town Hall lighting with Mr. Harry Moss, of Bradford, according to the scheme which he drew up and submitted to the Council. The lighting is to cost £20 per annum; the present cost is over £30.

Greenock.—The Electricity Committee recommends that the price charged for arc lamps be reduced from £18 to £15 per lamp—a total reduction per annum of £150. The estimates for the current year make provision for a net balance of £2,000.

Hertford.—Experiments are being carried out by the North Metropolitan Electric Supply Co. with 50-C.P. metallic-filament lamps for public lighting. If satisfactory, the T.C. will probably adopt these lamps.

Japan.—Messrs. Mitsui & Co. have decided to install two Nuremberg gas engines of 3,200 B.H.P. each, to operate on coke oven gas, at the power station at their Müki Mines, which have at present a Curtiss turbine installation.

Keighley.—The T.C. has decided that the following additional rates for electric power be added to the existing scale of charges for direct current:—For a half-yearly consumption of 650 units per electrical horse-power 1½d. per unit; for a half-yearly consumption of 800 units per electrical horse-power 1d. per unit; for a half-yearly consumption of over 800 units per electrical horse-power, terms to be agreed between the consumer and the committee; that the scale of charges for electricity for lighting purposes be extended as follows:—For a consumption exceeding 1,000 units per half-year 3½d. per unit; for a consumption exceeding 2,000 units per half-year, 3d. per unit; heating and cooking, flat rate of 1½d. per unit; supply to arc lamps, flat rate of 3d. per unit. It was also decided that the charge for electricity on the three-phase extra-high-tension system be based upon a £3 per kilowatt maximum demand, plus ¼d. per unit, a scale calculated on this basis being

approved. The following are the conditions:—The consumer to provide the transformer on his premises, except upon special terms to be agreed upon: the Corporation to run the cable into the building and to deliver high-tension power at the meter on the consumers' premises, beyond which point the consumer may use or transform the current as he wishes

London.—SHOREDITCH.—The accounts of the electrical undertaking for the 12 months ended March 31st last, show, the Lighting Committee reports, continued progress, the 12 months under review denoting a marked improvement on previous years. The total income compared with the previous year had increased by £1,598, while on the expenditure side of the revenue account there is a reduction of £1,032. The gross profit was £23,876 as against £21,335 in the previous year. The surplus on the year's working is £6,431, and is disposed of by wiping off the debit balance brought forward, and by transferring £1,486 to change of pressure account, and placing £4,000 to the reserve fund, leaving a credit balance of £616 to be carried forward. The total cost per unit sold shows a reduction of '28d., compared with the previous year. The present form of consumers' agreements enabling the Council to require consumers to take a two years' supply, is to be amended by the substitution of the following words for the existing clause: "The consumer shall continue to receive and pay for a supply of electric energy for a period of at least two years, and the minimum payment per annum shall not be less than £20 per cent. on the outlay incurred by the Council in providing any electric lines and apparatus required for the purpose of such supply unless a responsible tenant of such premises succeeds the applicant in agreeing in writing to take a supply of electric energy on similar terms from the Council." The proposed amendment will not affect any agreements at present in force, but all future consumers will be required to agree to this condition, which is in accordance with the provisions of the Shoreditch Electric Lighting Order, 1892.

The E.L. Committee recommends that a 66-cell storage battery, with the necessary switchgear, should be installed, at a cost of £685, in connection with the supply to the North-Western Railway Co.'s Eldon Street Depôt, so as to eliminate risk of breakdown.

Queen's Ferry.—The question of lighting the township by electricity has been raised by the West Saltney Council, and inquiries are being made as to the powers of parish councils to light villages in this way.

Rochdale.—The T.C. has fixed the following revised scale of charges for current for power to consumers having 15 H.P. and over installed:—Over 250 units and up to 300 units per quarter per B.H.P. installed, 1d. per unit; over 300 and up to 350, '9d. per unit; over 350 and up to 400, '8d. per unit; over 400 and up to 450, '7d.; beyond '6d. There is to be an alternative price of 25s. per quarter per electrical horse-power of maximum demand measured by the Corporation, and a flat rate of ½d. per unit, to consumers having a total of over 20 H.P. installed.

Stalybridge.—The application of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board for sanction to borrow £22,268 for electricity purposes, expenditure on mains, estimated cost of transformers, coal elevator, conveyors, and bunkers, and a mechanical stoker, was the subject of a L.G.B. inquiry on the 31st ult. Mr. Brocklehurst, who appeared on behalf of the Hyde Gas Co., opposed the application on the ground that the latter, as a ratepayer, had to support and help to finance what was undoubtedly a rival undertaking, and one which it appeared to him would, but for the support from the rates, have long ago been wound up.

Stevenage.—With reference to the threatened revocation of the E.L. Order, 1902, the B. of T. has informed the U.D.C. that it will be glad to learn at the end of September what steps have been taken to carry out the obligations imposed on the undertakers of the Order.

Sunderland.—The Electricity Committee of the T.C. has appointed a sub-committee to consider the advisability of establishing a sales department in connection with the electricity undertaking.

U.S.A.—At the farm of Mr. M. H. Miner, at Chasey, N.Y., covering some 5,000 acres, electricity is used for all the lighting and for driving machinery for all purposes. The River Chasey and the Tracey Brook have been impounded, giving heads of 30 ft. and 19 ft. respectively, which suffice to produce 60 H.P. and 200 H.P. in the two turbine plants which have been installed. Power is transmitted overhead to a distributing battery station on the farm, from which underground mains distribute energy to the farm buildings. In the dairy barn are motors operating the hay hoist and chaff cutter, also a 1½-H.P. motor driving a vacuum pump in connection with five milking machines. The milk, after being tested, is passed through a motor-driven separator, and the cream is subsequently churned electrically. A electrically-operated refrigerating plant, and a 25-H.P. motor-driven grist mill are also features of interest, the latter motor being a portable one, which can be used in the fields for thrashing or wood cutting. The electric motor also provides power for sheep shearing, root cutting, &c., and for clipping and grooming in the stable, in fact, wherever manual labour could be displaced, the motor has been substituted for it. In the homestead, electric cooking and heating are in use, and the laundry has a complete equipment of motor-driven washing, wringing, mangling, drying machines, &c., and flat irons. Several electrically-driven pumps are in use, also a sausage making plant, and the wagon repairing, blacksmith and sawing shops are equipped with motor-driven tools. In all 27 motors of 130-H.P. are in use, as well as a complete lighting installation.

The *Journal of Electricity, Power and Gas*, describing the steam plant of the City Electric Co., of San Francisco, mentions that the generating station is entirely equipped with steam turbines, amounting in all to 30,000 KW. Oil fuel is used, storage tanks of 40,000 barrels capacity being provided at 1,000 ft. and 500 ft. distance from the station, which are replenished from vessels and supply the Babcock boiler plant through an 8-in. pipe line. The burner oil pressure is about 60 lb. per sq. in., but is varied according to the fuel supply required, by a Witt regulator controlled automatically by the boiler steam pressure. The generating units comprise two 3,000-K.V.A., one 9,000-K.V.A., and one 15,000-K.V.A. Westinghouse-Parsons turbo-alternators supplying three-phase 60-cycle current at 11,000 volts pressure. Both the last two machines are of the double-ended type, steam entering at the centre of the turbine casing and passing first through an impulse element. The 15,000-K.V.A. set is one of the largest powered turbines in the States; its speed is 1,800 R.P.M., and a direct-coupled 75-KW. exciter is provided. The switchgear includes 15,000-volt oil switches, manually operated, but with overload relays, and a Tirrell regulator and six single-phase automatic induction regulators on the outgoing feeders are provided.

Warrington.—The L.G.B. has sanctioned the borrowing of £6,257 for the provision of additional plant at the electricity station.

Wimbledon.—Negotiations are proceeding with regard to the supply of electricity to Mr. Mulholland's new theatre. The Electricity Committee has agreed to a revised charge of 1d. per unit between midnight and 6 p.m., and the ordinary lighting rates at other hours, the minimum consumption to be 20,000 units per annum.

The B.T.-H. Co. has informed the Council that owing to difficulty in obtaining materials, the 1,000-KW. Curtis turbine for the Council would not be tested before September 24th.

TRAMWAY and RAILWAY NOTES.

Belfast.—It has been agreed to include in the tramways scheme, extensions of the Ravenhill Road line to Ormeau Road, and of the Newtonards Road line to Dundonald Cemetery.

Bexley Heath.—The U.D.C. on August 31st passed a resolution to the effect that having regard to the last report from the E.L. and Traction Committee as to the deficit on the tramway undertaking, the Council should give instructions for the immediate preparation of the financial statement of the working, &c., for the year ending March 31st, 1910, and to consider the same at an early date with a view to affording an explanation to the ratepayers. Mr. Baker Beall, who seconded this motion, said the real fact was that the whole of the loss was due to the Council itself, and to its abominable business in managing; they should not blame the manager.

Bradford.—A sub-committee of the Corporation Tramway Committee has been formed to carry into effect the provisions of the Bill with regard to a trackless car service. The only route sanctioned by the Bill is Rooley Lane, which will connect up Laisterdyke and Dudley Hill.

Brighton.—The Watch Committee of the Hove T.C. has received a communication from the Brighton, Hove and Preston Omnibus Co., asking it to consider a proposal for the adoption by the company of the trackless trolley system of traction for its 'buses. The Committee has, however, decided not to recommend the Council to favourably consider the scheme. The company has licences for about 36 'buses.

Continental Notes.—RUSSIA.—It is reported from St. Petersburg that a concession was granted some time ago to a company which proposes to undertake the preliminary work in connection with the construction of an electric railway between St. Petersburg and Imatra. The water power of the Imatra Falls is to be utilised for the production of power. The available water power would allow not only of the electric railway, which would be the first of its kind in Russia, being worked, but there would also be sufficient surplus power for various industrial undertakings along the route and in the capital. It is intended to seek for an enlargement of the concession in this respect, and the belief is expressed that the application will be granted.

Plans are being prepared by an English syndicate in respect of a projected narrow gauge electric railway between Sebastopol and Alushta, on the Black Sea.

SWEDEN.—The Svenska Almenna Electricitiäts Aktiebolag, of Westeras, and the Simens-Schuckert Co., of Berlin, have contracted with the Swedish State Railway authorities to establish a large electricity generating station at Torju to supply the power for the trains on a section of the Swedish railways.

AUSTRIA-HUNGARY.—The communal authorities of Smichow have decided to proceed with the construction of a tramway to Neu-Smichow and the Malvazinka-Friedhof at an estimated cost of £42,000.—*Board of Trade Journal.*

Coventry.—A public meeting was held on Saturday last at which resolutions were passed in favour of the Corporation purchasing the tramways from the owning company as a going concern.

Dundee.—The convener of the Tramways Committee—Mr. Alex. Spence—in submitting the estimates for the current year to the Town Council, stated that the department was in a very healthy condition, thanks to the able supervision of their manager, Mr. Fisher. At May 15th last their position was £1,750 better than had been expected, this permitting the placing of an additional £1,700 to the credit of the renewal fund and an additional sum of £50 to the accident fund. The respective sums placed to these funds were £3,600 and £800. In the estimates for the current year provision had been made for placing £4,700 to the renewal fund, £1,850 to the depreciation fund and £1,000 to the accident insurance fund. There was, he pointed out, a total of £43,830 standing at the credit of the various funds of the department at May 15th last, these being apportioned as follows :—Renewal fund, £25,064 ; depreciation fund, £14,400 ; accident insurance fund, £3,898 ; reserve fund, £468. The Board of Inland Revenue and other authorities had fixed an allowance of £275 per mile of single line per annum as the sum necessary for permanent way renewals in the case of Dundee. This meant on their 28 miles of single line, the setting aside of something like £6,875 per annum. On very few occasions had the department been able to set aside a sum as large as the present, and consequently it would be apparent that the fund was not increasing at the rate it should do. Mr. Spence held that the tramways department contributed more than a fair share of the rates, instancing the payment of the sum of £27,000 as their alleged share of street improvements and the yearly payment of from £3,000 to £4,000 per annum towards the maintenance of streets, all of which went towards reducing the rates.

Japan.—The new Japanese law regulating the construction of light railways, came into force on August 3rd. The object is to encourage the construction of light railways to connect minor centres of trade and industry with the existing lines of railway. A translation of the law may be seen by British firms at the Commercial Intelligence Branch of the B. of T.

The Special Committee appointed by the Municipal Council of Tokio to examine and report upon the project for the construction of an overhead electric railway in Tokio has decided to recommend the scheme. The proposed line is to start from Shinagawa, and pass along the seashore, and up the bank of the River Sumida as far as Senju.

Oldham.—The business at the T.C. on September 7th included the recommendation by the Tramways Committee to pass the following resolution :—"That the town clerk be instructed to apply to the B. of T. for its sanction to the Corporation borrowing the sum of £12,544 to cover expenditure already incurred on extensions of the feeder cable system in connection with their electric tramways."

Plymouth.—The B. of T. has written to the T.C. in regard to the alleged carrying of passengers on the cars in excess of the regulation number, and has been informed that the traffic instructions have been strictly adhered to except very occasionally. The Tramway Committee asks the Board to allow seven passengers to stand inside at times other than those mentioned in the existing regulations.

TELEGRAPH and TELEPHONE NOTES.

Balloon Wireless Experiments.—Mr. A. de Mowbray Bellairs and Lieut. Maitland have recently conducted experiments from a balloon at a height of more than a mile, using a portable wireless apparatus slung from the balloon. According to the report, it was shown that wireless telegraphy could be used in a more satisfactory manner than at the altitude at which wireless apparatus is usually erected.

International Telegraph and Telephone Congress.—The inaugural address of M. Millerand, French Minister of Public Works, at the Second International Congress, opened this week in Paris, mentioned that one matter for discussion was the standardisation of telephonic circuits, and another was the question of automatic telephonic communication. Twenty-two nations have sent official representatives to the Congress.

Naval Wireless Experiments.—Experiments are being made with a view to obtaining wireless communication with submarines, one of the latter having been equipped with the necessary apparatus. It is stated that messages have been successfully received by the submarine, although, as yet, no messages have been transmitted from the latter.

Proposed Hong Kong Wireless Station.—According to American Consular advices, an American syndicate proposed last year to establish a wireless station at Hong Kong, to give communication with Manila, Singapore, Shanghai and Yokohama, with a sole license for 25 years, but with Government right of purchase at earlier periods. The offer was refused by the British authorities. The American, German and Japanese mailboats calling at Hong Kong, are being equipped with wireless apparatus.

Wireless Compass.—According to the *Southern Electrician*, some Italian scientists have invented "a standard compass actuated by Hertzian waves," which, it is claimed, would enable a ship's captain to determine with accuracy the direction of the station from which messages were being received. This, it is claimed, would get over the difficulties due to a vessel drifting after an accident, providing signalling could be kept up.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 12th. Electrical goods, for the Powell Duffryn Steam Coal Co., Ltd. Stores Manager, Aberaman offices, near Aberdare.

Austria.—September 16th. The Austrian State Railway authorities (the Northern branch) in Vienna are inviting tenders for a number of alternating-current electric motors at the railway works at Floridsdorf.

September 19th.—The Austrian Ministry of Public Works in Vienna are inviting tenders for the establishment of a new telephone exchange in the Austrian capital.

Australia.—September 20th. Telegraph and telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 5th.

September 27th.—Electric lamps for the P.M.G.'s Department in Victoria. See "Official Notices" August 12th.

October 4th.—Telegraph and telephone insulators for the P.M.G.'s Department in all States. See "Official Notices" August 12th.

October 4th.—Telegraph and telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 19th.

October 4th.—Telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 19th.

October 5th.—5,000 porcelain insulators, for the P.M.G.'s Department in New South Wales. See "Official Notices" August 19th.

October 17th.—Telegraph and telephone material, for the Deputy Postmaster-General, Hobart. Commonwealth High Commissioner's Office, 72, Victoria Street, London.

VICTORIA.—Telephone cable and insulators, for the P.M.G.'s Department in Victoria. See "Official Notices" September 2nd.

MELBOURNE.—H.M. Trade Commissioner for Australia (Mr. C. Hamilton Wickes) reports that tenders will be received at the office of the Deputy Postmaster-General, Melbourne, as follows :—October 18th, for 23 miles of telephone cable (Schedule No. 284), and 500 composition insulators (Schedule No. 374) ; October 25th, for 10,000 Cordeau insulators (Schedule No. 373).

TASMANIA.—October 17th. Telegraph and telephone instruments and material, for the P.M.G. See "Official Notices" September 2nd.

Belgium.—September 13th. The authorities of the Hospice Civil at Saint-Gilles-lez-Bruxelles (25, Rue du Fort) are inviting tenders for an installation of electric lighting in the Hospital.

September 14th.—La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), are inviting tenders for the supply of the bronze overhead cables required during the 12 months ending September 30th, 1911.

Brighton.—September 13th. Electrical fittings for a year, for the B.G. R. Burfield, clerk, Parochial Offices, Brighton.

Calcutta.—September 19th. Motor-generators, turbo-alternators and condensing plant for the Cossipore station and substations of the Calcutta Electric Supply Corporation, Ltd. See "Official Notices" August 26th.

Chile.—September 30th. Three multiple dynamos and searchlights, also machines and tools, for the Chilian Navy. See this column in last issue.

Egypt.—October 20th. Electrical installation and refrigerating plant, for asylum at Khanka. Specification from Chief of Administrative Service, Public Works Department, Cairo ; for particulars as to tendering see *Board of Trade Journal*.

France.—November 1st. The Prefect of the Department of the Yonne, at Auxerre, is inviting offers for the construction of a system of metre-gauge electric or steam railways in the Department, the aggregate length of the proposed lines being about 233 kilometres.

Germany.—The municipal authorities of Munster are about to invite tenders for the establishment of a central electric lighting station in the town at an estimated cost of £20,000.

September 17th.—The Finanz Deputation at Hamburg is inviting tenders for 10 electric cranes at the port of Hamburg.

Grantham.—September 13th. Pump, with pipes and power, to convey water from well to water-tower at the rate of 400 gallons per hour, for the B. of G. ; A. H. Mallin, Clerk, 79, Westgate.

Littleborough.—September 13th. Alternating-current (single and three-phase) meters, for the U.D.C. See this column in last week's issue.

London.—HACKNEY.—September 15th. Extension of the main switchboard, for the Borough Electricity Department. See "Official Notices" August 12th.

Mountain Ash.—September 12th. Electrical stores for 12 months, for the U.D.C. See "Official Notices" August 26th.

Mozambique.—October 12th. The authorities of the Harbour and Railway at Lourenco-Marques, Mozambique, are inviting tenders for the supply of seven electrically-operated cranes, ranging in capacity from 1 to 10 tons.

Newport.—September 20th. Material required for extension works, for the Corporation Electricity and Tramways Committee. See "Official Notices" to-day.

New Zealand.—December 15th. Installations of wireless telegraphy at Doubtless Bay, Gisborne, Cape Farewell, Sumner and Bluff. See "Official Notices" August 5th.

South Africa.—DURBAN.—September 28th. Elevated jet condenser and piping, switchboard, rotary converters, cables and transformers, for the Corporation. See this column last week.

Spain.—Tenders have lately been invited by the municipal authorities of Valverde del Manzano (province of Segovia) for the concession for the electric lighting of the town during a period of 10 years.

The municipal authorities of Cadillero (province of Oviedo) are inviting tenders until the 30th inst. for the concession for the electric lighting of the town during a period of 20 years. Tenders are to be sent to, and particulars may be obtained from, El Secretario del Ayuntamiento de Cadillero.

Uruguay.—September 30th. The equipment of an electric generating station and the supply of electric light at San Fructuoso. See this column last week.

Walthamstow.—September 9th. Supply and erection of battery for the U.D.C. See "Official Notices" September 2nd.

Warrington.—September 13th. Electrical requisites for six months, for the B. of G. Arthur Bottomley, Clerk, Bewsey Chambers, Warrington.

CLOSED.

Australia.—According to the *Australian Mining Standard* Messrs. Sullivan & Ashman, Melbourne, the successful tenderers for the Ulverstone municipal electric lighting contract, are installing an 80-H.P. Allen high-speed engine and a 50-KW. generator, combined booster and balancer, made by the General Electric Co., Sweden, with marble switchboard on iron frame. Tudor accumulators will be installed; also a Babcock & Wilcox boiler. The price of the contract is £4,417.

VICTORIA.—The *Australian Mining Standard* states that the Postmaster-General's Department has placed the contract for 1,640 tubular iron poles with Siemens Bros. Dynamo Works, Ltd., Sydney.

Bournemouth.—The Tramways Committee recommended the acceptance of the tender of Messrs. W. Griffiths & Co., for tramrails, at £2,904. An amendment was moved for the substitution of a Leeds tender, at £3,299 for British rails, the recommended tender being for Belgian. In reply to a question the tramway manager said that the Belgian rails were superior. There were five votes for the amendment and 19 against, so it fell to the ground.

Blackburn.—The T.C. on September 1st accepted the tender of the Wigan Coal & Iron Co. for the supply of steam coal to the local Electricity Works, also that of Messrs. Burrows and Garland, ironmongers, for the supply of wrought-iron tubes to the Electricity Department.

Burnley.—The Electricity Department has accepted the tender of the British Insulated and Helsby Cables, Ltd., to supply cable needed for the Brierfield tramways, at £968 (less 5 per cent.).

Canterbury.—The B.G. has accepted the tender of Mr. Philpott, of Canterbury, for installing the electric light at the Woodville Homes.

Dewsbury.—The T.C. has accepted the tender of Messrs. Cowans, Ltd., of Salford, for a switchboard panel for the E.L. station; and that of the Liverpool Electric Cable Co., for cable for coupling up the turbo-generator set to the switchboard.

Glasgow.—The Clyde Navigation Trustees have accepted the offer of the Electric Construction Co. to supply two brake solenoids for the new electric turn-tables at Rothesay Docks, at a total of £25.

The T.C. Tramways Committee recommends the acceptance of the following:—

Rotary converter and switchgear, Partick sub-station.—British Westinghouse Co., Ltd.
Armature coils.—British Westinghouse Co., Ltd.
Motor-generator and storage battery, Partick sub-station.—Lancashire Dynamo & Motor Co., Ltd.
Cast-iron pipes.—Kerr & Co., Ltd.
Double lead-sheathed telephone and test cable.—British Insulated Co.
Double cotton-covered wires.—British Insulated Co.

Keighley.—On the recommendation of the Electricity Committee, the T.C. has decided to place an order with Messrs. Babcock & Wilcox, Ltd., for the supply of the second water-tube boiler, with superheaters, stokers, and steam pipes, at a cost of £1,458.

London.—SHOREDITCH.—The Lighting Committee has recommended for acceptance the tender of Messrs. Siemens Bros. and Co., Ltd., for the supply of service cables required during the next five months. The tenders submitted were as follows:—

Lead-covered, paper-insulated cables.	7/16.	7/14.	19/14.
Siemens Bros. & Co., Ltd. .. .. ..per mile.	£59 0	£73	£147
W. T. Glover & Co., Ltd. .. .. .. ,,	58 15	74	149
W. T. Henley's Telegraph Works, Ltd. ,,	59 0	74	150
Brit. Insulated & Helsby Cables, Ltd. ,,	60 0	76	155
Western Electric Co., Ltd. .. .. ,,	61 0	75	151

The Lighting Committee obtained quotations from five firms for supplying and installing a storage battery of 66 cells with a capacity of 750 amperes for two hours; also one battery switchboard panel with necessary instruments, switches, &c., including recording voltmeter and ammeter. It has provisionally accepted the tender (which was the lowest) of the Electrical Power Storage Co., Ltd., at £660, and £25 for cable and connections.

Rochdale.—The Tramway Committee has accepted the following tenders in connection with the extension of the line to Bacup:—

Hadfield's Steel Works, Sheffield.—Points and crossings.
Walter Scott, Leeds.—Rails.
Wm. Underwood, Dukinfield.—Permanent way.

Salford.—The T.C. has accepted the tender of Walter Scott, Ltd., for 500 tons of steel tramway rails, at £6 16s. 6d. per ton.

Wallasey.—The U.D.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for wattmeters.

The Tramways Committee has accepted the tender of Messrs. Millar's Karri & Jarrah Co. (1902), Ltd., for 90,000 wood paving blocks, at £8 3s. per 1,000.

FORTHCOMING EVENTS.

National Electrical Manufacturers' Association.—Tuesday, September 13th. At 2.30 p.m. At Balfour House, Finsbury Pavement, E.C. Committee meeting.

Municipal Tramways Association.—September 21st to 23rd. Annual conference at Bradford.

NOTES.

Inquiries.—A correspondent asks for the names of makers of electrically-driven small hammers, similar to pneumatic rivetters and equally portable.

A correspondent inquires for the manufacturer of the Howitzer suction cleaner.

A correspondent inquires for the English addresses of the makers of "Empire" and "Arnold" vibrators.

A correspondent inquires for the address of the importer of the "Duntley electric vacuum cleaner."

Electrical Engineers (London Division).—The Bohemian Concert of the Electrical Engineers (London Division), which was postponed on account of the death of King Edward, will be held in the Pillar Hall, Victoria Station (S.E. & C.R.), on Saturday, October 15th, at 7.30 p.m. Tickets and full information can be obtained from the secretary, C.S.-M. A. E. Dixon, at the headquarters, Regency Street, S.W.

Educational.—CITY OF LONDON COLLEGE.—The new term, with classes in magnetism and electricity, sound, heat, &c., commences on September 26th. Prospectus from the Secretary.

UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.—The 1910-11 session commences on October 3rd. Complete courses of study for the Faculty of Engineering are arranged. Full particulars from the Secretary. See our "Educational Notices" to-day.

The Harry Cox Fund.—Sir Wm. Treloar writes to the Press, stating that the above fund now amounts to £3,405. The fund is to close at the end of this month, but between now and then Sir William hopes to receive more subscriptions.

German Electrical Amalgamation.—The Berlin correspondent of the *Daily Telegraph* says:—"Already the largest electrical undertaking in Europe, the Allgemeine Electrizitäts Gesellschaft, will be able enormously to extend the sphere of its operations by the increase of its capital from £5,000,000 to £6,500,000, and by its practical absorption of the Felten-Guilleaume and Lahmeyer concerns, which were decided upon here yesterday. The Allgemeine Co. takes over bodily the dynamo works of the Felten Co. at Frankfort, paying for them in new shares, and at the same time, in conjunction with the Electro Bank at Zürich, acquires a predominant interest in the cable works at Mulheim and Nordenheim. These measures will give it a firmer footing in South Germany than it at present possesses, and a commanding position in the manufacture of submarine cables. In this branch of electrical industry it has hitherto been prevented from doing anything by the shallowness of the Spree, which does not allow vessels large enough to accommodate submarine cables to reach Berlin."

Cricket.—The Cambridge Electric Supply Co. played one of their best matches this season on Saturday, when they easily mastered a strong team representing St. Giles Juniors. The Juniors batted first, but owing to the capital bowling of Tabraham and Boness, only scored 94. The Electrics responded with 169 for the loss of three wickets only, and of this total F. Holden supplied 71 not out, and E. Tabraham 68 not out.

An interesting cricket match between the Ecco Battery and Electrical Co. and the Cape Asbestos Co. took place at Leyton last week, which resulted in a victory for the former, the scores being 85 against 49.

Publicity Literature.—The Electric Supply Publicity Committee—which is the new title of the London and District Committee, since its activities were extended to include provincial and Colonial work—has made a further issue of publicity matter, including an electric heating poster and booklet and a power booklet and mail cards to two separate designs. The heating poster measures 25 in. × 40 in., and is lithographed in colours; it represents one solution of the servant problem—Sarah Jane lost in admiration of the cleanly electric radiator. The heating booklet is suitable for enclosure in an ordinary business envelope with accounts. The power booklet illustrates and describes briefly the possible savings which can be made in first outlay, space, labour, running costs, risks, &c., by adopting electric driving. In view of the importance of this question, we would suggest to the Publicity Committee the advisability of instituting a competition for posters, show cards, &c., much on the same lines as that recently held by the London Underground Railways, for in a matter of this kind only the best is good enough.

Electrical Enterprise in India.—The *Times* correspondent at Bombay says that an Indian company is being formed for the generation of electricity by water storage at Lanauli, in the Western Ghats, for transmission to mills and factories at Bombay. "The company is to have a capital of 170 lakhs of rupees (£1,133,220), 70 per cent. of which has been already subscribed. The scheme is to furnish 30,000 H.P., with a reserve of 10,000 and possibilities of expansion to 50,000." The correspondent adds that this is the biggest industrial enterprise inaugurated in India, except the Tata Ironworks. The issue is under the auspices of the Tata firm.

Electrical Dentistry.—One of the most noticeable features of the Dental Exhibition which was opened on Monday, September 5th, at the Horticultural Hall, Westminster, is the many uses to which electricity is put by the up-to-date dentist.

One of the chief exhibits of the Exhibition is a modern dental surgery, on the wall of which is a switchboard fitted with some 15 switches, the switchboard, by the way, being beautifully decorated and coloured to match the wall and floor coverings; through this switchboard current is supplied to numerous electrical appliances, some of the more novel of which are the following:—An electrical mouth lamp, an electrical cautery for cutting away the overgrowth of gums, an electrical heater for keeping solutions of antiseptics at blood heat, an electrical root dryer, an electric hot-air syringe for the aero massage treatment, in which compressed air supplies the force by which diseased gums are massaged and sprayed at the same time with antiseptics, while the compressing of the air for this treatment is also carried out by means of an electric motor, which is coupled to the compressor and which automatically starts as soon as the pressure in the air tank falls below a certain level.

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—A meeting will be held at the Beaconsfield Room, Grosvenor Restaurant, Glasgow, at 6 p.m., on Saturday, September 17th, 1910, to extend the membership, and promote the formation of one or more Scottish branches of the Association.

Association of Mining Electrical Engineers (South Wales Branch).—A visit by the members of this branch to Messrs. D. Davis & Son, Ltd., Tylorstown, Ferndale, will take place on Saturday, September 24th. Members and friends wishing to attend this visit should notify the local secretary at 113, Clive Road, Canton, Cardiff, on or before September 19th inst.

Appointment Vacant.—Electrician to take charge, at the University of London, University College (30s. to 34s.) See our advertisement pages in this issue.

Street Lighting Fittings.—With reference to our notice under New Devices, &c. (page 374), of certain street lighting fittings for tungsten lamps, the firm mentioned wish to acknowledge the assistance of Mr. Cameron Gibson, electrical engineer, Nuneaton, in connection with the "Bentark" design.

Modern Lighting.—Correction.—The words "candle-feet" appearing in Table I, and the accompanying references, on page 432, should read "cubic-feet."

Electrical Imports and Exports in August.—According to the official figures published yesterday, there was an increase of £481,159 in exports of electrical goods as compared with the same month of 1909. The imports of electrical goods and apparatus increased by £52,768. The electrical exports for the year down to date show an increase of £1,169,412 as compared to the same period of 1909. The general exports for the month were £6,524,183 better than for August, 1909, but this year there was an extra working day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On Friday last the staff and workmen of the West Bromwich Corporation electricity works presented Mr. F. A. Couse, engineer-in-charge, with a case of cutlery, on the occasion of his marriage. Mr. W. A. Jackson, the borough electrical engineer, made the presentation.

Mr. L. H. King, electrical engineer to Whitby U.D.C., whilst motoring from Scarboro' to Whitby last Saturday with Councillor Briggs and another friend, met with rather a serious mishap. Owing to the failure of headlights, the car struck some grass at the side of the road, and was turned over into the hedge. All the occupants were stunned and shaken, and Mr. King has received injuries to his back which will compel him to lay up for some time.

Mr. D. Tattersall, who has served the Ingleton Electric Lighting and Power Co., Ltd., as engineer since 1903, has now been appointed engineer-secretary to the company.

The staff of the Burslem electricity undertaking has presented a travelling case to Mr. Ashton Bremner, whose management of the undertaking comes to a close, owing to the federation of Pottery towns.

Mr. A. Black has resigned his position as engineer-in-charge at the Bradford Corporation Electricity Works, having received an appointment with Messrs. J. & P. Coats, Ltd., Paisley, N.B.

On Friday last, Mr. J. W. Fraser was the recipient of a handsome writing case, subscribed for by the employés of the London County Council tramways power house, Greenwich, on his leaving the department in order to take up a Government appointment.

The Salford Electricity Committee has decided to promote Mr. E. H. L. Dickson, mains superintendent, to the position of deputy borough electrical engineer, at his present salary of £270 per annum, rising by biennial increases of £25 to £325.

Tramway Officials.—Mr. W. Wilde, who has for nearly four years been in charge of the Castleford section of the undertaking of the Wakefield Tramways Co., has been appointed traffic superintendent at Wakefield. The Castleford staff has presented Mr. Wilde with a timepiece on his departure.

General.—Mr. Sidney Ransom, of the Westinghouse Co.'s publishing department, has left for India to take charge of the Theosophical Society's electrical plant at Adyar, Madras. On Friday, September 2nd, his Westinghouse colleagues presented him with a gold watch.

On Wednesday, August 31st, Mr. Percival L. Davies, of Downes and Davies, Liverpool, was married to Miss Margaret E. Sharp, of Garston, Liverpool.

Mr. A. T. Lambert has resigned his post as works manager for Messrs. W. A. Stevens, Ltd., electrical and mechanical engineers, of Maidstone, to take up the position as engineer and manager to the Maidstone Corporation Light Railways.

Obituary.—Herr Isidore Loewe.—We regret to learn from the *Times* that Herr Isidore Loewe, head of the firm of Ludwig Loewe, and who in 1892 founded the Union Electrical Co., of Berlin, in connection with the Thomson-Houston Co., of Boston, passed away last Saturday week, in his 62nd year. The deceased gentleman was identified with numerous financial and industrial enterprises.

The death of Mr. Wm. Anderson, for many years managing director of the Dublin United Tramways Co., occurred on August 31st, at Dublin.

We also regret to record the death of Sir Chas. Euan Smith, chairman and director of many electrical companies, including the Marconi Wireless Telegraph Co.

NEW COMPANIES REGISTERED.

William H. Sayer & Co., Ltd. (111,590).—This comany was registered on September 2nd, with a capital of £500 in 10s. shares, to take over the business of an electrical and mechanical London and export merchant carried on by W. H. Sayer, at 15, New Street, Bishopsgate, as "W. H. Sayer and Co." The subscribers (with one share each) are:—W. H. Sayer, 15, New Street, Bishopsgate, E.C., engineer; F. G. Flewett, 165, High Street, Teddington, clerk. Private company. W. H. Sayer is the first director. Registered office, 10, New Street, Bishopsgate, E.C.

George Hill & Co., Ltd. (111,526).—This company was registered on August 30th, with a capital of £4,000 in £1 shares, to take over the business carried on by George Hill & Co., at 12, Cornbrook Park Road, and 11, Virgil Street, Manchester, and to carry on the business of electricians, engineers, manufacturers, &c. The subscribers (with one share each) are:—A. R. Walmsley, Newton Lodge, Links Gate, St. Annes-on-Sea, engineer; Mrs. A. K. Walmsley, Newton Lodge, Links Gate, St. Annes-on-Sea; R. Barron, Glenelg, Palatine Road, Blackpool, engineer. Private company. The number of directors is not to be less than two or more than three; the first are A. R. Walmsley, A. K. Walmsley and R. Barron; qualification, £500; remuneration as fixed by the company. Registered office, 12, Cornbrook Park Road, Manchester.

United Lighting and Maintenance Co., Ltd. (111,517).—This company was registered on August 29th, with a capital of £2,000 in £1 shares, to take over the business of electricians, &c., carried on by S. Mundler, at 35, Cock Lane, E.C., as the National Lighting Co.—The subscribers (with one share each) are:—M. Kaiser, 274, Elgin Avenue, W., Commissioner International Exhibition; S. Mundler, 35, Cock Lane, Snow Hill, E.C., merchant; J. W. May, 34, Cock Lane, Snow Hill, E.C., merchant; Mrs. R. I. Law, 36, Carlton Mansions, Maida Vale, W.; O. J. Proctor, 36, Carlton Mansions, Maida Vale, police pensioner. Private company. The number of directors is not to be less than two or more than five; the first are M. Kaiser, S. Mundler and J. W. May; qualification, £25; remuneration, £20 per annum, divisible. Registered office, 35, Cock Lane, Snow Hill, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Madras Electric Supply Corporation, Ltd. (87,409).—Return dated August 3rd, filed August 16th. Capital, £400,000 in £5 shares. 60,000 shares taken up. £300,000 paid. Mortgages and charges: Nil.

Chilian Electric Tramway and Light Co., Ltd. (57,203).—Return dated July 21st, filed July 26th, 1910. Capital, £1,150,000 in 500,000 ordinary and 650,000 pref. shares of £1 each. All shares taken up. £650,000 paid on the pref. £500,000 considered as paid on the ordinary. Mortgages and charges: £433,400.

Chili Telephone Co., Ltd. (29,252).—Return dated July 28th, filed August 3rd. Capital, £250,000 in £5 shares. 44,000 shares taken up. £220,000 paid. Mortgages and charges: Nil.

United River Plate Telephone Co., Ltd. (23,654).—Return dated August 2nd, filed August 10th. Capital £1,000,000 in 150,000 ordinary, 40,000 pref. and 10,000 unissued shares of £5 each; 150,000 ordinary and 40,000 pref. shares taken up; £5 per share called up on 134,000 ordinary and 40,000 pref.; £870,000 paid; £80,000 considered as paid on 16,000 ordinary shares. Mortgages and charges: £300,000.

Electric Construction Co., Ltd. (39,292).—Return dated July 28th, filed August 10th. Capital £400,000 in 150,000 pref. and 50,000 ordinary shares of £2 each; 112,100 ordinary and 31,390 pref. shares taken up; £2 per share called up on 2,100 ordinary and 18,245 pref.; £40,690 paid; £246,290 considered as paid on 110,000 ordinary and 13,145 pref. Mortgages and charges: £210,000.

Van Raden & Co., Ltd. (78,383).—Mortgage dated August 15th, 1910, to secure £1,850, charged on freehold factory, land and premises at Coventry. Holder: C. W. Hill, The Moat, Exhall, Coventry.

Imperial Lamp Works (Brimsdown), Ltd. (101,306).—Issue on August 18th of £25,000 debentures, part of a series of which particulars have already been filed.

William Coates & Son, Ltd. (2,172).—Deposit of deeds on August 19th, 1910, securing all moneys due and to accrue from the company to holders, charged on premises in Castle Street, Belfast.

CITY NOTES.

Belgian Electrical Companies.

THE report of the Ateliers de Constructions Electriques de Charleroi states that the value of the orders received in 1909 amounted to £338,000, as compared with £328,000 in the preceding year. In order to meet the development of trade the erection of new shops had been commenced at La Villette for the construction of large machines and alternators for turbines, and it had also been decided to establish a small foundry for the needs of the workshops, whilst the question of erecting a cable factory for the manufacture of all kinds and sizes of cables was under consideration. The various departments were satisfactorily employed during 1909, and installations for collieries were increasing every year. No fewer than 60 important collieries were now regular customers, for whom the company had already constructed, or the work was in progress, either power stations and sub-stations, winding engines, ventilators, centrifugal pumps, mining locomotives or motors for washing and screening plant. By means of the profits realised on securities in portfolio, it had been possible to write down the value of the works to 1s. this comparing with £24,000 in 1908, and it was intended to endeavour to fully write off new equipment out of general expenses every year. The accounts show a profit balance of £23,300 for 1909 and a dividend at the rate of £1 8s. per share, or 7 per cent. has been declared on the priority capital, and 8s. per share on the ordinary shares, as against 6s. in 1908.

The directors of the A.E.G.-Union Electrique, of Brussels, in the course of their report for 1909, refer to the increase in the share capital from £100,000 to £140,000, which took place at the beginning of the year, and state that the resumption of business after the crisis which arose in 1908, had not yet been manifested in an effective manner. Nevertheless, the working results permitted of the payment of the same rate of dividend on the larger capital, despite the consequential advance on the founder share coupons. These favourable results were achieved by the normal development of business, which continued for installations in collieries and iron and steel works and various industries, as well as in undertakings and supplies for tramways and central stations. The net profits realised in 1909 reached £15,500, as compared with £11,100 in the previous year, and a dividend at the rate of 13s. 6d. per share has been declared on the ordinary shares as in 1908, and 8s. 10d. per share on the founder shares, this comparing with 6s. 2½d. in the previous year.

The Compagnie Internationale d'Electricité, of Liége, which has an issued share capital of £251,000 and a bond capital of £80,000, realised net profits of £24,000 in 1909-10, as compared with £17,400 in the preceding year, and the former sum has been wholly devoted to the purpose of depreciation in order to further consolidate the company's financial position. According to the directors' report, the workshops were well supplied with work during the year, and the orders on hand in July, 1910, were larger than in the corresponding period in 1909. The economical organisation of the shops made further progress, and the manufacture of normal dynamos and motors on a large scale had been fully achieved, and had given the best results from the standpoints of reducing the cost of production, the good utilisation of the plant and a large output. It had been decided to install improved machine tools, and the work was already in progress. During the year important installations, notably in collieries and iron and steel works, were carried out with satisfaction to the customers.

Ibbotson Bros. & Co., Ltd.—The thirty-eighth annual report states that the profit for the year ended June 30th amounts to £22,964, to which has to be added £11,116 brought forward. The directors recommend that a final dividend be paid of 6s. per share, tax free, making 10 per cent. for the year, that £3,000 be added to the reserve fund, and that the balance of £11,645 be carried forward.

Canadian General Electric Co., Ltd.—The directors have declared a dividend of 1¾ per cent. on the common stock for the three months to 30th inst., being at the rate of 7 per cent. per annum. A half-yearly dividend of 3½ per cent. for the six months ending September 30th, 1910, being at the rate of 7 per cent. per annum, has also been declared on the preference stock.

Stock Exchange Notices.—The Committee have appointed Friday, September 9th, as a special settling day in:—

Electric Light and Power Co., of Cochabamba—Scrip, fully and partly paid, for £300,000 6 per cent. Government Guarantee Loan.

And ordered the undermentioned to be quoted in the Official List:—

Interborough Rapid Transit Co.—$1,397,000 additional 5 per cent. 45-year gold mortgage bonds, Series "A" of $1,000 each, within Nos. 1,591 to 3,052.

Vera Cruz Electric Light, Power and Traction, Ltd.—The report, according to the *Financier*, states that the net profits in Mexico for the year to December 31st amount to £19,043, as compared with £9,603 for the year 1908, being an increase of nearly 100 per cent. The outlook for the year 1910 is favourable. The balance at the credit of profit and loss account, including the balance brought forward, amounts to £2,271, which it is recommended should be carried forward. In March the directors arranged with the holders of the 6 per cent. debenture bonds for £300,000, which were redeemable by the company at six months' notice, to exchange these bonds for £250,000 5 per cent. first mortgage debenture bonds to bearer (repayable by the operation of a sinking fund commencing in 1916), and £50,000 ordinary shares credited as fully paid. The share capital was consequently increased to £350,000, and an issue of 5 per cent. bonds to an authorised amount of £300,000 was created, of which £250,000 was immediately issued.

The Swiss Bank for Electrical Enterprises.—The shareholders in the Bank fur Elektrische Unternehmungen, of Zurich, have just approved the payment of a dividend at the rate of 10 per cent. for 1909-10, and sanctioned the raising of the share capital from £1,600,000 to £2,400,000; most of the additional capital of £800,000 is to be devoted to the realisation of the scheme for the establishment of a community of interests with the Elektrizitäts Gesellschaft vorm. W. Lahmeyer & Co., of Frankfort-on-Main, by means of an interchange of shares of the two companies. It was stipulated by the bank that the project could only be carried into effect provided that applications for an exchange of shares were made by Lahmeyer shareholders representing a minimum of 60 per cent. of the shares. It appears that during the time the offer was open the minimum was exceeded, and thus assured the success of the scheme; but, in order to render the interchange all the more thorough, the period for applications has been extended to September 15th. Without, however, waiting for any further action in this respect, the shareholders in the bank have approved the election on the board of directors of the following representatives of the Lahmeyer group:—Walther von Rath, Carl von Grunelius, Carl von Neufville, and Prof. Bernhard Salomon, all of Frankfort, together with Georg von Simson, manager of the Bank fur Handel und Industrie, of Berlin, and Hans Schuster, of the directorate of the Dresden Bank of Berlin.

Davis & Timmins, Ltd.—The directors recommend the payment of the interest on the 6 per cent. preference shares and an interim dividend on the ordinary shares at the rate of 6 per cent. per annum for the half-year ended June 30th, 1910.

Continental.—GERMANY.—The report of Messrs. Brown, Boveri & Co., of Mannheim, for the last financial year shows a net profit of only £15,598, as compared with £24,758 in the preceding 12 months. The dividend is being reduced from 6 to 4 per cent.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	*	No. of wks.	Total to date. £	*	Route miles open.	Inc.
Aberdeen	Aug. 31	3,273	+ 92	13	20,510	— 262	..	..
Ayr	Sept. 3	711	— 19	16	6,818	+ 274	8	..
Bath	„ 3	2,000	+ 190	35	29,728	+ 1,429	..	..
Belfast	„ 2	8,077	+ 668	22	89,746	+ 4,058	37	..
Birkenhead	„ 4	2,180	+ 108	22	25,168	+ 619	13·68	..
Birmingham Corp.	Aug. 27	13,863	+ 879	21	143,101	+ 1,408	56·46	..
Blackburn	„ 31	1,985	— 85	22½	24,843	— 1,041	14·62	·12
†Blackpool Corp.	„ 25	2,716	+ 563	..	33,434	+ 1,666	..	..
Blackpool-Fleetw'd	Sept. 3	3,064	+ 58	9	14,808	+ 320	..	..
†Bolton	Aug. 28	2,396	+ 73	22	51,608	— 245	26	..
Bournemouth	„ 31	4,674	+ 180	21½	44,453	+ 3,991	21·96	..
Bradford	„ 27	10,512	+ 500	22	111,103	+ 3,631	54·8	..
Brighton	Sept. 4	2,528	+ 18	22½	24,379	— 43	9·5	..
Bristol	„ 2	12,477	+ 765	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Aug. 26	434	— 38	34	7,375	+ 23	3·65	..
Barnsley	„ 26	417	+ 2	34	5,905	+ 181	..	..
Barrow	„ 26	622	+ 86	34	9,228	+ 1,346	5·37	..
Cavehill	„ 26	212	— 28	34	3,186	+ 134	..	..
Devonport	„ 26	930	+ 162	34	14,404	+ 1,888	8·85	..
Gateshead	„ 26	1,093	— 10	34	33,520	— 196	11·25	..
Gravesend	„ 26	468	— 30	34	7,102	— 5	6·5	..
Greenock	„ 26	1,516	+ 165	34	21,487	+ 2,844	7·25	..
Hartlepool	„ 26	6·8	+ 97	34	8,512	+ 529	6·72	..
‡Kidderminster	„ 26	282	+ 3	34	3,852	+ 107	..	..
Leamington	„ 26	460	+ 43	34	5,744	+ 211	..	..
Merthyr	„ 26	433	— 12	34	7,055	— 241	2·9	..
Metropolitan	„ 26	15,941	+2,464	34	253,033	+43,950	22	..
Middleton	„ 26	781	— 31	34	10,910	— 682	8·5	..
Mid. Joint Com'tee	„ 26	12,122	— 22	34	195,362	+ 2,405	..	..
Oldham—Ashton	„ 26	285	— 13	34	18,920	— 106	9·13	..
Peterborough	„ 26	1,230	+ 18	34	3,956	— 86	5·31	..
Potteries	„ 26	3,433	— 17	34	59,228	— 636	29	..
Rothesay	„ 26	1,089	— 90	34	8,068	+ 49	2·75	..
Southport	„ 26	752	+ 16	34	10,227	+ 173	8·17	..
S. Metropolitan	„ 26	2,044	+ 107	34	28,349	+ 1,207	..	..
Swansea	„ 26	2,389	+ 197	34	36,911	+ 4,201	12·5	..
Tynemouth	„ 26	997	+ 89	34	9,202	+ 493	3·75	..
Weston-s-Mare	„ 26	861	— 38	34	5,441	— 86	3	..
‡Worcester	„ 26	687	+ 33	34	9,684	+ 178	5·75	..
Wrexham	„ 26	208	— 18	34	3,307	— 21	..	..
Yorks. Wool. Dist.	„ 26	2,139	+ 142	34	33,534	+ 2,790	17	..
Miscellaneous	„ 26	539	+ 6	34	7,451	+ 324	..	..
Burnley	Sept. 3	2,458	— 64	..	..	..	..	..
Burton-on-Trent	„ 4	588	+ 46	22	6,451	— 12	6·6	..
Bury	„ 4	2,403	+ 72	22½	26,865	— 404	22·5	..
†Cardiff	Aug. 13	2,446	— 99	20	44,642	+ 325	..	..
Carlisle	..	..	..	..	..	..	..	..
†Chatham and Dist.	„ 25	1,028	+ 99	34	28,751	+ 1,051	14·98	..
Cork	Sept. 1	1,040	+ 31	34	16,599	+ 1,630	9·89	..
†Croydon	Aug. 26	3,482	+ 112	..	36,765	+ 3,382	11·25	..
Darlington	Sept. 3	426	+ 51	23	4,602	+ 293	..	..
†Darwen	„ 2	492	+ 4	22	5,530	— 124	4·36	..
Dover	Aug. 27	719	+ 48	21	5,094	+ 104	4·75	..
Dublin	Sept. 2	13,417	+ 746	..	56,571	+ 731	54·25	..
Dundee	Aug. 31	2,588	+ 2	15½	19,083	+ 283	15·5	..
East Ham	Sept. 3	2,114	+ 150	22½	23,518	+ 578	8.52	..
Exeter	„ 2	733	+ 12	22	7,512	— 689	5·5	..
Glasgow	„ 3	34,881	+1,119	..	23),040	+12,148	97·75	3·25
Hastings	„ 1	3,066	+ 26	..	..	..	..	..
Huddersfield	„ 3	3,418	+ 103	23	39,702	+ 2,024	27·5	1
Hull	„ 3	5,572	+ 315	22	60,508	+ 3,439	14·5	..
Ilkeston	„ 1	280	— 29	22	2,883	— 85	..	..
†Ipswich	„ 3	1,047	+ 49	22	10,293	+ 594	10·5	..
†Kilmarnock	„ 3	152	+ 14	16	2,546	+ 70	4·25	..
Lancashire United	Aug. 31	2,550	— 82	..	45,775	— 571	39	..
Leeds	„ 27	14,148	+ 323	21	152,813	+ 4,876	..	..
Leicester	..	..	..	..	..	..	..	..
Leith	Sept. 3	1,320	— 42	15½	10,440	+ 14	8·7	2
Liverpool	Aug. 27	22,503	+ 674	34½	379,466	+13,827	113·5	4
‡L.C.C.	„ 24	83,288	+9,661	..	881,099	+118,470	136	12
London United	Sept. 3	13,738	+ 54	..	225,406	+ 9,468	..	..
Lowestoft	..	..	..	..	..	..	..	..
Manchester	„ 3	30,431	+ 770	22	345,957	+ 5,866	133	1
Newcastle	„ 3	7,552	+ 161	..	89,264	+ 1,074	14·5	..
Newport	Aug. 27	1,398	+ 41	22	15,324	+ 548	14·5	..
Oldham	Sept. 4	3,755	+ 52	23	43,524	— 1,017	23·75	..
Pontypridd	..	..	..	..	..	..	..	..
Portsmouth	Aug. 27	5,665	— 230	21	47,601	— 1,703	15½	..
Preston	„ 24	1,493‡	— 38	21	15,616	— 338	..	..
Rotherham	..	..	..	..	..	..	..	..
†Salford	Sept. 5	4,909	+ 323	23½	105,465	+ 1,462	..	..
Sheffield	„ 4	11,876	+ 686	23½	139,335	+ 8,171	30·8	·8
Southampton	Aug. 31	2,425	— 75	22	24,970	+ 488	..	..
Southend-on-Sea	„ 31	1,954	+ 359	22	15,059	+ 1,467	..	..
South Shields	Sept. 3	1,284	+ 63	22½	13,064	— 36	..	..
†Swindon	Aug. 24	154	+ 11	..	..	..	..	..
Tyneside	„ 31	922	+ 47	9	4,601	+ 885	..	..
Wallasey	„ 29	2,135	+ 176	21½	21,108	+ 63	..	..
†Walthamstow	„ 27	761	+ 44	21	16,078	+ 1,002	9	..
West Ham	„ 25	4,940	+ 260	21	52,633	+ 2,196	15·25	..
Wolverhampton	„ 31	1,808	+ 274	22	21,129	+ 3,006	14·25	1·75
Cen. London Rly.	Sept. 3	9,675	+ 431	9	46,860	+ 2,661	6·82	..
City & S. Lon. Rly.	„ 4	6,061	+ 197	9	27,552	+ 204	7·26	..
Dublin-Lucan Rly.	„ 2	372	+ 25	9	1,681	+ 70	7	..
G.N. and City Rly.	„ 3	2,625	+ 145	9	11,597	+ 599	3·5	..
L'pool Overh'd Rly.	„ 4	2,858	+ 56	..	14,845	+ 58	6·3	4·3
Llandudno-Col. Bay	Aug. 26	1,584	+ 34	33½	10,769	+ 39	..	..
London Elec. Ry. Co.	Sept. 3	21,165	— 225	9	102,730	+ 385	21·25	..
Mersey Railway	„ 3	3,812	+ 56	9	17,480	+ 254	4·5	..
Metropolitan Rly.	„ 4	31,765	+ 987	..	148,008	+ 5,032	24·5	..
Met. District Rly.	„ 3	18,581	+ 908	9	80,980	+ 5,593	24	..
Anglo-Argentine	„ 2	88,062	+10,350	..	1,543,742	+131,289	..	..
§Auckland	July	14,747	+1,412	..	..	..	23	·7
Bombay (B.E.T.)	Sept. 5	5,041	+ 375	31	83,603	+ 6,139	..	..
§Brisbane	Aug.	21,950	— 47	32	144,795	+18,548	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 3	7,331	+ 311	..	..	..	..	..
§Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	July	3,455	..	..	24,026	..	20·5	..
Madras	Aug. 31	1,392	— 16	..	21,550	+ 1,219	..	..
Montevideo	Aug.	22,256	+3,045	40	235,619	+22,746	..	..
§Lisbon	..	..	..	..	..	..	..	..
†Perth (W.A.)	July 15	1,529	+ 149	..	48,978	+ 8,871	29	1

* Compared with the corresponding period of 1909. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

THE condition of business in the markets leaves a good deal to be desired, but investment is quietly returning to the Stock Exchange. This last is manifest in the difficulty experienced in the selection of sound securities that yield 4½ to 5 per cent. on the money. The searching through lists is of little value, because the very stocks that buyers would be glad to have are in many cases quite unobtainable. In our recent little tables of investments we have been careful to include only such stocks as were actually on offer; but even so, in the list we gave last week, one or two are already taken and the prospective buyer finds himself unable to get any stock. In such cases it is always safe to blame the source of the suggestion.

Good Telegraph issues are an example of our meaning. In the shares there is generally a free market, more or less, but when Debenture stocks are sought, the difficulty of getting them is apparent. The dealers who sell stock are frequently left short of it, and the investor who has bought it naturally waxes indignant at its non-delivery, and in the bitterness of his soul he writes cutting letters to the halfpenny papers, just as he would write, only more cuttingly, if the dealers declined to sell stock that he wanted to buy. However, they are adopting this latter course more and more, and by advancing quotations in the Official List they endeavour to draw stock to market in order to satisfy the ever-increasing circle of buyers.

Amazon Telegraph shares have gained ⅛, and the same fraction has been added to the prices of Chili Telephones, Direct Spanish Telegraph Ordinary and Preference, and West India and Panama shares. Western Telegraphs are easier, and can again be bought to return a level 5 per cent. on the money. Great Northern Telegraphs are up 5s., so are Direct United States, Eastern Extensions and Cuba Telegraphs. United River Plate Telephones rose $\frac{3}{16}$ and the Preference $\frac{1}{16}$, while steady improvement continues to take place in Debenture stocks in this market. On the top of the rises that have occurred amongst Telegraph and Telephone issues for several weeks past, the present advance is significant of good buying. A good 4½ per cent. bond is that of the New York Telephone Company. It can be bought at about 99¼, and carries a coupon due November 1st.

The gamble in Anglo-American Telegraph Deferred is active as ever, and the fluctuations depend largely upon the circumstances of prices in the American Railroad market. At the time of writing, the price shows a rise on the week. The Preferred and Ordinary have held their substantial gains, the latter being a further 10s. to the good.

The hope may, perhaps, be permitted that the rise of 3 points in Underground Electric 4½ per cent. bonds is gratifying to some who have read the various recommendations made here from time to time. District Ordinary is ¼ to the good, but Metropolitan Consolidated keeps merely steady, and the electric railway issues are unchanged. Brighton Railway stocks have come to the front this week, the Ordinary and Preferred rising 2 and 3 points respectively. The latest labour difficulties have so far had but slight effect upon the prices of the steam stocks, the Stock Exchange view being that so grave a crisis will be short as it is sharp.

Metropolitan Electric Tramways Ordinary have hardened, and British Electric Traction Debenture stocks are good, the 5 per cents. being 2 better, and the 4½ per cents. rising a point. Brush 4½ per cent. perpetual Debenture being quoted *ex* dividend, is marked down to 39½. In the foreign group, Calcuttas, of both kinds, are better, and Mexico Trams rose 1½. The bonds have just been quoted *ex* dividend. Rio Trams are 96¾, and Sao Paulos are good at 155.

Industrial and manufacturing shares are mostly firm. Castner-Kellners have hardened to just on £3 a share. Babcock & Wilcox rose to 5⅛. British Insulated Ordinary and Preference are both 5s. to the good, the former attracting attention by reason of their high yield. Henley's are now *ex* their 5s. dividend, but the price has declined only half that amount. The 4½ per cent. Preference shares are 5 middle, also *ex* dividend.

Electricity Supply shares remain quiet and almost featureless as regards the Metropolitan issues. Brompton Preference have been marked down $\frac{1}{16}$, and London Electric Preference ⅛, *ex* 3s. dividend. Amongst Provincial shares, Newcastle-on-Tyne Ordinary and Preference are ⅛ higher, to bring the prices into consonance with the prices in the local list.

The principal features in the Electricity market are the rises in Mexican Electric Light bonds and Mexican Light and Power issues. Mexican Light and Power Common rose 5 and the Preference 3½. In explanation of the demand, the market simply say that the public are ready to buy second-grade investment stocks, as well as bonds.

Rubber shares are dull and spiritless. The auction sales to-day, Tuesday, went sluggishly as regards the prices obtained for the material, and there is nothing at the moment to induce renewal of appetite for the shares on the part of the public.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Aug. 30th.	Closing Quotations Sep. 6th.	Business done week ended Sep. 6th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ — 3⅞	3½ — 4	..	..	+ ⅛	Nil.
286,500	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	95 — 97	95 — 97	..	..	..	4 17 7
255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	8 %	136 —139	139 —142	139	..	+3	5 12 8
53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
558,460	Anglo-American Telegraph	Stock	3¾%	3¾%	£3 4s.	3⅜%	67½ — 69½	68 — 70	..	..	+ ½	5 3 7
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	110 —112	110 —112	111½	110½	..	5 7 2
3,220,770	Do. do. do. Deferred	Stock	1¾%	1 %	8/-	25/-	27⅜ — 27⅝	27½ — 28⅛	28¼	27½	+ ¼	4 9 3
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101½ —103½	100½ —102½ xd	..	..	..	4 17 7
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	9¼ — 9⅝	9¼ — 9⅝	9¼	..	+ ⅛	4 2 1
2,449,176	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	85½	84½	..	4 13 0
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8¾ — 9	8¾ — 9⅛	8⅛	..	+ ⅛	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16¼ — 17½	16⅝ — 17⅜	..	..	+ ⅛	5 15 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅜ — 3⅝	3½ — 3⅝	..	..	+ ⅛	5 6 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7¾ — 8⅜	8 — 8½	..	..	+ ⅛	12 10 0
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100—102	100 —102	..	..	..	4 8 3
60,710	Direct United States Cable	20	4½%	4½%	4½%	4 %	15⅛ — 16	15⅜ — 16⅛	16⅛	15⅛	+ ⅛	4 17 0
35,000	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	132 —135	133½—135½	134½	133½	+ ½	5 3 4
2,000,000	Do. 5½ % Pref. Stock.	100	5½%	5½%	5½%	5½%	84 — 86	84 — 86	84½	84¼	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	102½—104½	102¾ — 104⅝	103¾	103	..	3 16 7
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅜ — 12⅝	12⅝ —13⅛	12⅝	..	+ ⅛	5 5 8
752,400	Do. 4 % Deb. Stock.	Stock	4 %	4 %	4 %	4 %	99½—102½	100 —102	..	..	+ ½	3 18 5
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5⅝%	5⅝%	5⅝%	10⅜ — 11	10⅜ — 11	10⅝	10⅜	..	5 6 6
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13 — 13½	13 — 13½	..	..	..	4 8 11
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	29½ — 30½	30 — 31	..	..	+ ½	5 18 6
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	53 — 55	53 — 55	..	..	..	6 15 8
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	86 — 89	86 — 89	..	..	+ ½	4 14 5
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 78	74 — 78	..	..	..	5 2 7
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	3⅜ — 3⅝	3⅜ — 3⅝	17/-	15/9	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	3⅜ — 3⅝	3⅜ — 3⅝	..	..	..	6 4 8
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	3⅜ — 3⅝	3⅜ — 3⅝	18/6	..	..	5 3 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105½	104 —105⅝	105½	104½	..	5 13 9
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	123 —125	123 —125	124	123½	..	4 16 0
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5⅜	..	..	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97⅞ — 99½	99 —100	..	..	+1	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	98½—100⅝	99 —101	..	..	+ ½	3 19 3
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	7 %	8 %	8 %	8 %	1⅜ — 1⅝	1⅜ — 1⅝	32/-	..	..	4 18 6
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	4 7 3
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87½	87	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	96¾ — 98½	97 — 99	..	..	+ ½	4 0 10
11,889	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	98 —100	98½—100½	..	..	+ ½	4 9 7
3,042	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	..	130 —133	132—135	..	..	+3	4 8 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞ — 7⅛	7 1/16 — 7 1/16	7⅛	7 1/16	+ 1/16	5 9 5
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅞	5⅛ — 5⅜	..	..	+ 1/16	4 10 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅜ — 1⅝	1 1/16 — 1 1/16	..	..	+ 1/16	4 10 2
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	96¼ — 98½	97 — 99	..	..	+ ⅛	4 0 10
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	7 %	14 — 14½	13⅞ — 14⅛	14 1/16	13⅞	— ⅛	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100—102	100 —102	..	..	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1⅛ — 1⅜	1⅛ — 1⅜	18/6	15/3	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	6 %	8⅛ — 9	8⅛ — 9	..	..	..	6 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	14½%	8 — 9	8½ — 9½	..	..	+ ½	15 6 10
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100—102	101—103	..	..	+1	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	..	5 %	4 7/16 — 4 1/2	4 7/16 — 4 1/2	91/10½	90/-	..	5 6 8
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	..	5 %	4⅜ — 4⅝	4 7/16 — 4 7/16	..	..	+ 1/16	5 12 8
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	91 — 92½	91 — 92½	92½	91⅝	..	4 6 6
332,387	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
830,000	Babcock & Wilcox, 1 to 830,000	1	20 %	20 %	20 %	24 %	5 7/16 — 5 1/2	5½ — 5⅝	5⅝	..	+ 1/16	4 4 3
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1⅛	1 1/16 — 1⅛	..	..	..	5 19 0
1,000,000	British Aluminium 5 % Mort. Debs. Red.	100	..	..	..	..	..	..	..	..	..	5 9 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	143 —147	143 —147	144⅜	..	..	5 8 10
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	124 —128	124 —128	125¼	..	..	4 18 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	110 —113	111 —114	113⅜	111½	+1	4 7 9
333,000	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
133,301	British Electric Traction	10	Nil	Nil	Nil	Nil	⅛ — 1	⅛ — 1	15/-	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1⅜%	Nil	2⅜ — 3⅛	2⅜ — 3⅛	55/-	53/9	..	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	86 — 90	88 — 92	88	..	+2	5 8 8
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 73	69 — 74	..	..	+1	6 1 7
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6⅞ — 7⅛	7 — 7⅜	7⅛	..	+ ⅛	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅞ — 6⅛	6 — 6⅛	..	..	+ ⅛	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
204,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	100 —103	99 —101 xd	..	..	..	4 9 1
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	5/16 — 3/8	5/16 — 3/8	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	61 — 63	61 — 63	..	..	..	6 7 0
50,000	†Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref... ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	37 — 42 xd	..	..	..	10 14 4
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	22 — 26	22 — 26	..	..	..	17 6 8
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	+ ⅛	4 14 9
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	5 %	5 %	5 %	5 %	4⅛ — 4⅜	4⅜ — 5	..	..	+ 1/16	5 0 0
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9 — 10	9⅜ — 9⅝	9 3/16	..	..	5 0 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4⅞ — 5⅛	4⅝ — 5⅛	..	..	..	4 15 3
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100½—102½	101 —103	101½	101⅓	+ ⅓	4 7 5
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	12½%	2⅛ — 2⅜	2⅛ — 3	59/6	58/3	+ 1/16	4 3 4
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	64 — 66	64 — 66	64⅞	64½	..	4 10 11
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	85⅜	..	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	47 — 49	47 — 49	..	..	..	4 1 8
1,480,000	City and South London Railway	Stock	2½%	2½%	1½%	1⅜%	27⅞ — 28½	27⅝ — 28½	28⅜	28	..	6 2 10
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	83 — 86	83 — 85	..	..	— ½	5 17 8

* Unless otherwise stated, all shares are fully paid. † From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Aug. 30th.	Closing Quotations Sep. 6th.	Business done week ended Sep. 6th, 1910.		Rise + or Fall —	Present Yield per cent.
		*	1906.	1907.	1908.	1909.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	6 %	1 — 1⅛	1 — 1⅛	...	...	..	5 6 8
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	22/6	22/-	..	5 6 8
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅜ — 13⅜	12⅜ — 13⅜	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	2½%	Nil	Nil	1/16 — 1/16	1/16 — 1/16	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189	5	4½%	2½%	Nil	Nil	1 — 1⅛	1 — 1⅛	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	63 — 68	63 — 68	..	..	..	5 17 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1⅛ — 1⅛	1⅛ — 1⅛	..	..	..	9 6 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7⅞ — 8	7⅞ — 8	..	..	..	6 5 0
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 13 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	½%	Nil	Nil	⅜ — 1	⅜ — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10¼ — 10⅜	10¼ — 10⅜	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103½	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12⅛ — 12⅝	12 — 12⅜ xd	12⅛	12	..	5 16 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5½	4⅞ — 5⅛ xd	..	..	..	4 7 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	10 %	14½ — 15	14½ — 15	14⅞	14½	..	6 13 4
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	½%	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ — 5½	5 — 5½	..	..	..	9 10 6
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	3 %	Nil	..	1½ — 2½	1½ — 2½	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1½ — 2½	1½ — 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3⅜%	..	2 — 2½	2 — 2½	46/3	..	..	15 0 0
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 71	67 — 71	..	..	..	5 12 8
5,782,062	Metropolitan Consolidated	100	1 %	½%	½%	1 %	38 — 38½	38⅜ — 39¼	38½	38	+ ¾	2 10 11
2,640,914	Do. Surplus Lands	100	23%	23%	23%	23%	65 — 67	65 — 67	66	65½	..	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	20½ — 20⅝	21⅛ — 21⅜	21⅛	21	+1	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	5%	3/32 — 1/16	1/16 — 1/16	15/-	..	+ ½	6 3 1
814,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	1/3	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/8 — 3/16	1/8 — 3/16	15/9	15/7½	..	5 14 3
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	6 %	121 —123	122½ — 124½	124½	122½	+ 1½	4 16 5
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	..	5 %	5 %	99⅜ —100⅜	97⅞ — 98½ xd	100⅜	97⅝	..	5 1 9
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	3/32 — 1/8	1/16 — 1/8	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/8 — 3/16	1/8 — 3/16	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	34 — 36	34½ — 36½	36	34⅝	+ ½	5 14 9
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100½ —102½	..	..	+ ½	3 18 1
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	..	5 %	..	103 —104	103 —104	104	103½	..	4 16 2
2,800,000	Do. do. 4½ % Bonds	..	..	..	4½%	4½%	89 — 91	92 — 94	94	90½	+ 3	4 15 9
4,900,000	Do. do. 6 % Income Bonds	..	..	..	..	..	¾ 39 — 41	39 — 41	39½	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	3/32 — 1/8	1/16 — 1/8	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	8 11 5
245,495	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	60 — 70	60 — 70	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

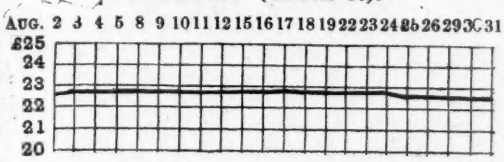
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	6 15 7
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6 13/16 — 7 5/16	6⅞ — 7⅛	..	..	..	4 14 11
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅜ — 3⅞	3⅜ — 3⅞	..	..	..	6 9 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	4 17 0
445,786	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3⅞ — 4¼	3⅞ — 4¼	..	..	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11⅛ — 11⅝	11⅛ — 11⅝	11⅛	11 5/8	..	6 0 5
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅛ — 12¼	11⅛ — 12¼	11⅛	11⅛	..	4 19 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	120 —124	120 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99½ —102½	99½ —102½	..	..	..	4 7 10
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1½ — 2	1½ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅝ — 3¼	2⅝ — 3¼	..	..	..	7 13 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94½ — 96⅞	94½ — 96⅞	..	..	..	5 3 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 7⅞	7⅝ — 7⅞	..	..	..	6 7 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11	10⅝ — 11	10⅞	..	..	5 9 1
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —107	104½ —107½	105	..	+ ½	4 3 9
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	Nil	3/32 — 1/8	1/16 — 1/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	Nil	1⅞ — 2	1⅞ — 2	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	75 — 78	75 — 78	..	..	..	5 15 5
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	85 — 88	82½ — 85½ xd	..	..	..	5 17 0
10,000	Folkestone, 1 to 10,000	5	5⅛%	5⅛%	5⅛%	5⅛%	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	7 — 7⅛	7 — 7⅛	..	..	..	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	100½ —102½	100½ —102½	..	..	..	4 17 7
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	6⅞ — 7¼	6⅞ — 7¼	..	..	..	5 10 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
11,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅝ — 2	1⅝ — 2	..	..	..	4 8 11
70,000	Do. do. 6 % Pref.	5	6 %	6 %	6 %	..	5 5/16 — 5 5/8	4 15/16 — 5⅛ xd	..	..	..	5 15 8
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½ %	4½%	4 %	4 %	90 — 92	90 — 92	..	..	..	4 7 7
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	3¼ — 3⅜	3¼ — 3⅜	71/3	..	..	7 8 2
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4 — 4⅛	4 — 4⅛	..	..	..	5 0 0
285,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	103	..	..	4 5 9
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	82 — 85	82 — 85	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	84⅞ — 85⅞	87 — 88	87⅞	85⅞	+ 2½	5 13 8
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	4 %	3½%	4 %	79 — 81	84 — 86	86⅝	79⅝	+ 5	4 13 0
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	104 —106	107⅞ —109½	109	104½	+ 3½	6 7 10
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	93 — 94	93⅝ — 94½	94½	93⅜	+ ½	5 5 10
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95⅝ — 97½	95⅝ — 97⅝	..	..	..	4 12 4
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½%	..	3⅞ — 4¼	3⅝ — 4⅜	82/6	..	+ ⅛	2 17 3
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4¼ — 4½	4⅜ — 4½	..	..	+ ⅛	5 2 7
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	..	5 %	100 —102	100 —102	..	..	..	4 18 0
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12 — 13	12 — 13	..	..	..	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6⅜ — 6⅞	6⅜ — 7⅛	..	..	..	5 1 10
119,694	River Plate Elcty. Co. Ord.	Stock	2½%	6 %	8 %	9 %	210—225	210—225	..	..	..	4 0 4
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	6 %	105—115	105—115	..	..	..	5 4 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100½ —102½	100½ —102½	..	..	..	4 17 7
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	7⅞ — 8¼	7⅞ — 8⅛	7⅞	..	..	6 1 3
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6½ — 7¼	6½ — 7¼	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	..	..	..	4 1 5
72,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1½ — 2	1½ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	3/32 — 1/8	1/16 — 1/8	..	..	..	6 13 4
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1 1/16	1 1/32 — 1⅛ xd	..	..	..	6 16 7
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¼ — 1	¼ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2½	2 — 2½	..	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	3/32 — 1/8	3/32 — 1/8	..	..	..	5 14 8
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8 — 8½	8 — 8½	8⅜	..	+ ⅛	5 11 1
51,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	5 1/16	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

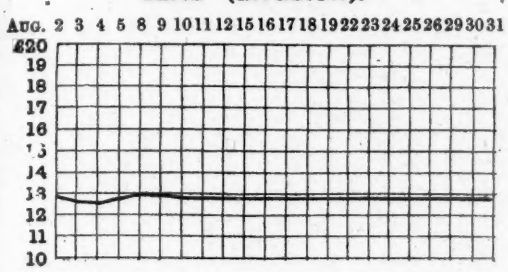
METAL MARKET.

Fluctuations in August.

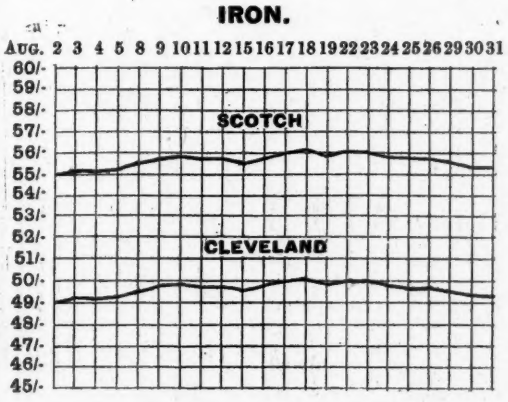
SPELTER (G.O.B's.).



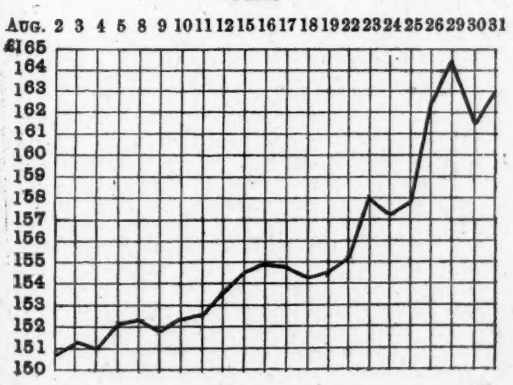
LEAD (ENGLISH).



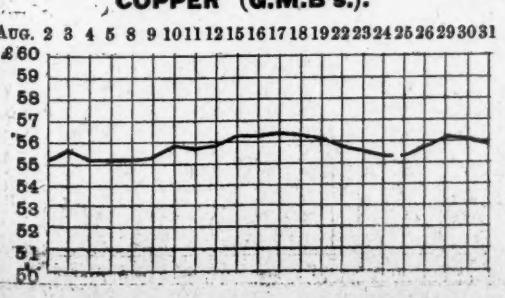
IRON.



TIN.



COPPER (G.M.B's.).



BRITISH TRADE IN THE RUSSIAN FAR EAST.

In a recent report on the trade of Vladivostok and district, the British Consul states that the comparative insignificance of British trade in that district is undoubtedly due to the fact that no attempt was made in earlier times to gain a footing. This allowed foreign firms which foresaw the ultimate development of the country to consolidate a position which it would be very difficult now to shake. Moreover, local traders and merchants are used to dealing with German exporting firms, and have always found them willing to fall in with their methods; to quote with Russian weights and measures, and to send catalogues printed in the Russian language; moreover, being established on the spot and with a thorough organisation behind them, these firms can offer terms of credit which British houses, not being locally represented, besides being unfamiliar with local conditions, would find it quite impossible to consider. German houses are notably assisted by the fact that the large volume of German goods imported had rendered possible the organisation of direct steamship services from Hamburg and Antwerp which ensure to German and Belgian goods an advantage in freight over British goods and also avoid the delays of transhipment.

The apathy with which this country has been regarded in the past by British trade is regrettable, and does not appear to be justified by circumstances, for over and above the important purchasing element provided by Government demands directly and indirectly, there should be taken into consideration that of the local population, the extent of whose wants has probably not been realised. It is true that it is small and extremely scattered, consisting mainly of peasants whose requirements are few and simple; yet, compared with the peasant class in European Russia, those in Eastern Siberia are in a position of relative affluence. Consequently it is extraordinary that no serious or consistent effort was made to obtain a share of the trade, and this in spite of the fact that Vladivostok is within easy reach of such important commercial centres as Shanghai, Tientsin and Yokohama. Why this should be so is hard to say, but it is probable, in the first place, that the big British firms established in the Far East, have found till recent times that the Chinese and Japanese trade was sufficiently remunerative to occupy all their energies, and that in the second place, they have held aloof on account of the general spirit of ignorance and mistrust with which they seem to have regarded things Russian. Undoubtedly the opening up of business in Russian territory requires special experience and knowledge of Russian trade methods and traditions which British Far Eastern firms do not possess, but it is remarkable that not one of them has taken the pains to try and acquire these. Within the last two or three years signs of a change of attitude have become discernible, and it is satisfactory to be able to note that several enterprises of real importance have been taken in hand recently by British firms who have taken the initiative in exploiting the country's natural resources. These enterprises have not been uniformly successful; there has been a tendency to inaugurate them without proper study of local conditions and necessities.

No difficulties are placed in the way of foreign trade provided that persons desirous of entering into commercial relations will take the elementary precaution of learning the language of the people with whom they wish to deal, and will quote to them with weights and currency with which they are familiar.

Both of these points have been dwelt upon *ad nauseam* in the reports of those who have studied the possibilities of British trade recovering its proper position in the Russian market; neither of them has as yet obtained the attention it deserves. They are both of capital importance and their observance by German firms has been a most powerful factor in their success. In Asiatic Russia generally the English language is, to all intents and purposes, unknown, and advertising matter prepared in that language is next to useless. In Vladivostok and other commercial centres there is a general acquaintance with the German language, but throughout the country this language also is almost useless and the employment of Russian is imperative.

The use of Russian weights and measures and of Russian currency in quotations is most strongly to be recommended. The inch and the foot are, of course, universally accepted, but, with the exception of these, neither our measures nor our weights or coinage are understood, and their use, even in Vladivostok itself, puts us at a serious disadvantage. The metric system is fairly widely known, and is in current use among the larger firms dealing in foreign goods.

A passing allusion has been made above to the great extension of the credit system here—a feature which probably owes its existence to the fact that the country is a new one with numerous opportunities for investment, but which, for various reasons, has not till latterly attracted capital in any large quantities from the outside. Here cash transactions are, except in the case of foreign firms, comparatively rare; the great number of payments are effected by means of "veksels"—that is to say, promissory notes—which, though legally transferable, are, as a rule, taken direct to the banks and there discounted against the signatures of the drawer and payee and in some cases a third signature. Veksels are currently given here for from 3 to 18 months; the banks discount them usually up to 9 months. The present rate of discount in private banks for these transactions is 8½ per cent. for veksels at 3 months, 9 per cent. for those at 6 months, and 9½ per cent. for those at 9 months. It will be observed that money here is exceedingly dear, and business is severely handicapped by the impossibility of obtaining funds at lower rates. These rates can be kept up because there are only two private banks doing the business, so that competition is limited.

MODERN LIGHTING.

By C. TOONE.

The present brief article is merely intended to introduce a few tables and a design chart, which the writer has compiled from various sources (including his own tests). The notes may be divided into two sections—(*a*) Dealing with the luminous efficiency of various sources; (*b*) Dealing with the intrinsic brilliancy of the same, and means whereby it may be reduced to desirable values. In this section the use of the convenient diagram shown in fig. 1 is explained.

Section (*a*).—The data of Table I is fairly exhaustive, and needs little explanation. The figures in the last column, while showing the immense superiority of flame arcs over all other known artificial light sources, also emphasise the very poor *absolute* (as opposed to *relative*) results yet obtainable. The luminous efficiency of the best gas mantles is very low (see Table I), and only the low cost of the form of energy employed enables it to compete with even the least efficient of the electrical lamps. A word of explanation is needed concerning the centre columns of Table I. It will be seen that the consumptions of gas and electric lamps are there expressed in both candle-feet and B. of T. units in both cases. The conversion of the gas consumption figures to electrical units and *vice versa* is effected on the assumption of a 100 per cent. efficiency of conversion, *i.e.*, the wattage value of the total calorific value of the gas burnt is calculated in one case, and in the other is determined the candle-feet of gas of gross calorific value equal to the wattage absorbed by the lamp. While such a conversion enables a very ready appreciation of the relative efficiency of various electrical and gas lamps, it is essential to note that *an exact equivalent* (*i.e.*, 100 per cent. efficiency) *is assumed between the two forms of energy* concerned. It is assumed throughout that the calorific value of the gas burned is 600 B.TH.U. per candle-foot, and that 1 KW.-hour equals 3,414 B.TH.U. The gas equivalent of a given electrical consumption is, therefore, *not* the volume of gas which, used in a gas engine, would enable the generation of the stated electrical energy; it is simply the thermally equivalent volume assuming 100 per cent. efficiency of conversion. This point has been emphasised, at the risk of tedium, since unless it is fully appreciated confusion must arise.

To obtain the electrical equivalent of a given oil consumption per candle-power under the above conditions, multiply the gallons of oil per candle-power by the ascertained calorific value in B.TH.U. per gallon; divide by 3·414, and the quotient is the equivalent electrical efficiency in watts per candle-power.

Section (*b*).—During the past few decades the average person has been gradually brought to require a higher and higher artificial illumination in his streets and living rooms; whereas "farthing dips" were the standard unit of illumination a few generations ago, few rooms now have a lamp of less than 16 C.P., while many comparatively small rooms employ several hundreds of candle-power. This cumulative desire for more intense illumination must not, however, be carried too far. Beyond a certain illumination, the useful effect obtained decreases as the intensity is further augmented. The pupil of the eye becomes unduly contracted, the muscles of the eye are strained and, in time, permanently damaged. At such high illuminations the optical sensitivity of the eye is much decreased. With the introduction of metallic-filament lamps the necessity for preventing the eye from receiving *direct* illumination from the source was much increased by the higher intrinsic brilliancy of these light sources (see Table II). With the high intrinsic brilliancy of most present-day luminous sources, it is not sufficient to merely place the lamp out of the direct line of vision. Where mirrors are used to any great extent, it is almost impossible, except in "indirect" illumination, to so place lamps that either the real source, or some of its reflections, do not come in the direct line of vision. Even apart from such cases, it is desirable, for uniform illumination and on account of the very concentrated nature of the source, to employ either (1) globes; (2) shades or reflectors; or (3) to adopt indirect lighting.

The use of more or less opalescent globes increases the effective luminous area of the light source, and hence decreases its luminous intensity; it must be remembered, however, that the total available candle-power is reduced by from 10 per cent. to 50 or 60 per cent., according to circumstances. The Moore vacuum lamp has the lowest intrinsic brilliancy yet achieved in any commercial lamp (see Table II); this is a very important advantage, and such a source can be used without any globe or diffusing medium. The inefficiencies of indirect lighting need not be incurred in order to attain uniform and convenient lighting. The mercury vapour lamp is similarly, though less, fortunate in this respect.

Incandescent filament lamps are frequently, and arc lamps practically always, used in conjunction with a diffusing globe. This should be of such a nature and size as to result in a mean intrinsic brilliancy of its surface of from ·0005-·0020 C.P. per sq. mm.—or as nearly within this range as is practicable. Globe diameters of more than 40 cm. are not convenient, hence the suggested globe surface brilliancy is frequently exceeded in the case of flame arcs. The diagram reproduced in fig. 1 will be found very useful in globe design. By its aid the required globe diameter for a given surface brilliancy can be estimated, the M.S.C.P. of the source and the nature of the globe material being known. Conversely, with the same known factors, the probable brilliancy of a globe of a certain diameter can be determined; again, a suitable globe material can be decided on if the remaining conditions are specified. The first suggested application is carried out as follows; the means of effecting the others will be obvious. To find the diameter of opal

TABLE I.

Type of lamp.	Energy consumption.		Mean consumption per 100 C.P.-hours.		Visible total.
	Candle-ft. gas per C.P.-hour.	Watts per C.P.	Candle-feet gas.	KW.-hours.	Per cent.
Hefner	—	120·0	—	120	0·10
Kerosene	—	48·0	—	48	0·25
Fish-tail burner ...	0·400	71·0	400	71	—
Argand „ ...	0·320	56·8	320	57	—
Welsbach mantle ...	·070—·080	12·4—14·2	73·5	13	—
Inverted „ ...	·050—·075	8·8—13·3	62·0	11	See below.
High-pressure mantle	·033—·050	5·8—8·8	42·5	7½	—
Upright mantle ...	·045	8·0	45·0	8	0·46
Inverted „ ...	·039	7·0	39·0	7	0·51
Acetylene	—	16·0	—	16	0·65
Carbon filament ...	·020—·023	3½—4	21·2	3·75	2·70
Nernst „ ...	·0057—·010	1—1·75	8·5	1·50	4·20
Tantalum „ ...	·0096	1·70	9·6	1·70	4·90
Osram „ ...	·0057—·0079	1·0—1·4	7·0	1·25	5·40
Cooper-Hewitt ...	·0028—·0037	0·50—0·65	3·1	0·55	2·25
Quartz mercury ...	·0013—·0017	0·23—0·30	1·52	0·27	6·00
Open D.C. arc ...	·0057—·0071	1·00—1·25*	6·3	1·12	5·60
Enclosed arc (D.C. and A.C.)	·0085—·0102	1·50—1·80*	9·3	1·65	1·20
Open A.C. arc ...	·0073—·0085	1·30—1·50*	7·9	1·40	2·00
D.C. flame arc / A.C. „ „	·0011—·0028	0·20—0·50*	1·7	0·30	13—15

* Reckoned on energy expenditure in arc alone.

TABLE II.

Source.	Intrinsic Brilliancy. C.P. per sq. mm.	C.P. per sq. in.
Sun	1,000	645,000
Arc crater	160	103,000
Nernst filament	2·2—4·7	1,420—3,050
Tungsten „	2·2	1,420
Tantalum „	1·4	900
Osmium „	1·1	710
Carbon „	0·4—0·9	260—580
Incandescent gas mantle ...	0·077	50
Mercury vapour lamp ...	·005—·025	3·25—16·2
Moore lamp	·0016	1·03

globe required to give a surface brilliancy of about 0·10 C.P. per cm.^{2} with a lamp of M.S.C.P. = 975 :—

Through the point, on the left-hand scale of fig. 1, representing 975 C.P., draw a straight line through the point representing 0·10 C.P. per cm.^{2} on the second scale (from the left). Produce this line to cut the centre axis in a point A (this centre axis is purely constructional). Referring to the table at the head of fig. 1, it will be seen that the constant $k = 0{\cdot}50$ for opal globes; hence, through a and the point representing K = 0·50, draw a straight line which, produced, cuts the right-hand scale in a point representing D = 39·5 cm. (15½ in.), *i.e.*, the required globe diameter is

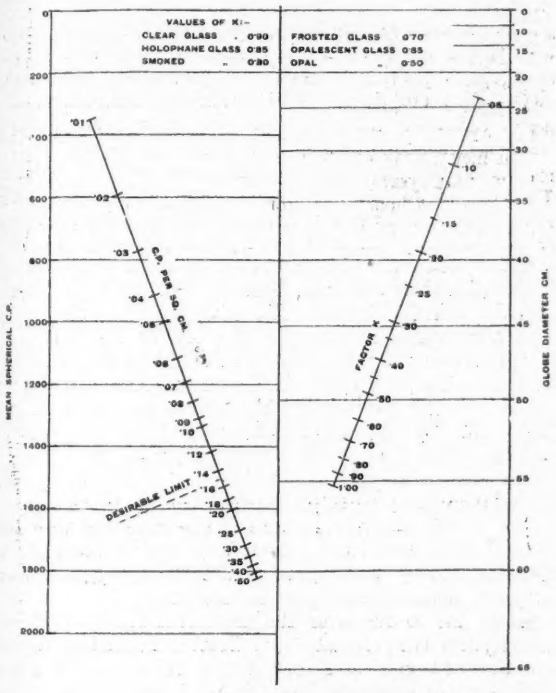


FIG. 1.

about 40 cm. From Table III it appears that about 40 per cent. or 50 per cent. absorption may be expected with such a globe (large globes absorb a higher percentage than small globes of the same material).

No further explanation of the scope and use of fig. 1 appears necessary.

The desirable illumination in most interiors lies between 0·7 and 2·0 candle-feet, as will be gathered from Table IV, which gives usual values of the illumination attained in various places. Whatever the illumination decided upon, it should be obtained as uniformly as possible over the whole area lighted. This condition is best satisfied by the use of a large number of low candle-power lamps evenly distributed over the area lighted, if direct lighting has to be used. By this means, and by using diffusing shades, excellent results may be attained. Such a course is economically impossible when a very large space has to be lighted as cheaply as possible; in such cases, high candle-power flame arcs, high-slung, give the best results.

For interiors, the best illuminating system is undoubtedly that of "indirect" lighting; the source should be entirely hidden from view behind a reflector, the inner surface of which should be silvered to avoid loss by absorption (see Table V). The reflected light should fall on a clean *white* ceiling, or on a matt white enamelled reflector if the former

TABLE III.

Clear glass ...	... 5—15 %	Ground glass	... 30—40 %
Rippled glass	... 20—25 %	Heavily ground glass	40—50 %
Holophane glass	... 20—30 %	Opal glass ...	... 50—60 %

is not available. It is very important, for obvious reasons, that this secondary reflecting surface should :—

1. Be a good diffusing surface.
2. Absorb a minimum percentage of light.
3. Be white in colour, so as not to change the nature of the light at this, its first advent into the space to be lighted. Indirect lighting is of necessity rather inefficient, but if properly installed, the excellent uniformity of illumination reduces the average candle-power required per square foot lighted by an amount almost compensating for the reflection losses.

The colour of the wall paper employed is of such importance in securing uniform illumination, that Table V is

TABLE IV.

			Illumination. Candle-feet.	Illumination. Bougie Metres (or lux).
Natural.		Daylight—in open (8 a.m.—4 p.m.)	2,000—8,000	23,500—94,000
		Moonlight maximum	0·028	0·33
		,, London (bright) ...	0·013—0·017	0·154—0·200
		,, New York (average)	0·014	0·165
		Skylight at night (no moon—New York	0·001	0·0118
Artificial.	In open.	Mean street illumination ...	0·085—1·70	1—20 (7 mean)
		Minimum ditto — small streets	0·0085	0·10
		Minimum ditto—medium busy streets	0·085—0·128	1·0—1·5
		Minimum ditto—city main streets	0·170—0·255	2·0—3·0
	Interiors.	Average interiors	0·70—2·0	8·0—23·5
		Railway carriages ...	0·20—1·0	2·35—12·0
		For reading and writing: well-lit tables ...	1·0	12·0
		Lecture halls, shops, textile factories, machine shops	1·5—3·0	17·5—35·5
		Picture galleries and museums	1·7—3·2	20·0—37·5
		Drawing offices	2·5—4·0	29·5—47·0
		Theatre stages	3·0—4·0	35·5—47·0
		Diffused daylight	10—40	120—470

of value in indicating the relative absorbencies of various papers; when possible, the choice of a decorating scheme should be deeply influenced by these considerations. The information given in Table V can only be regarded as representative, since a precise and exhaustive classification of colours is impracticable; also the nature of the "finish" of

TABLE V.

	Material.	Mean percentage of reflected light (angle incidence 35°—45°).	
Direct reflection :—			
	Best mirrors	90 %	
	Average mirrors	80	
Diffuse reflection :—			
	White blotting paper	82 %	Sumpner
	,, cartridge ,, ...	80	Sumpner
	,, foolscap ,, ...	70	Sumpner
Average paper and cloth fabrics.	Deep cream	55—60	
	Light green	50	
	Yellow and buff	45—50	
	Light grey	42	
	Pink	36	
	Light blue	34	
	Ecru	30	
	Medium blue	25	
	Medium green	22	
	Medium brown	15	
	Light red and crimson	9—10	
	Dark green	7½	
	Dark brown	7	
	Dark red	6½	
	Dark chocolate	4	
	Black cloth	1—1½	
	Black velvet	0·4	
	Tissue paper	40—45	Sumpner
	Newspaper	50	Sumpner
	Yellow wall-paper	40	Sumpner
	Tracing cloth and thick parchment ...	35	Sumpner
	Deal, yellow cardboard	30	Sumpner
	Tracing paper	20—25	Sumpner
	Yellow painted paper, thin parchment and planed deal	20	Sumpner

a paper or paint has an appreciable effect on its coefficient of absorption, and so has the angle of incidence. The coefficient of reflection of various papers is not the same for daylight as for light emitted by electric lamps. The light from filament lamps is rich in red rays, hence it would be expected that reddish papers, &c., would show a higher, and blueish papers a lower, coefficient of reflection for this artificial light than for daylight. This difference is actually found to exist, and frequently amounts to 10, 20 or even 30 per cent. It will readily be appreciated, therefore, that

the reflecting powers of a given wall cannot be accurately predetermined. The amount of data available is as yet insufficient to warrant more than *relative* conclusions regarding various materials. Attempts to predetermine by calculation the illumination obtained in "indirect" lighting schemes are usually abortive.

The writer has seen the reflecting power of a "faint yellowish green grey" paper gravely carried to several places of decimals and the angle of incidence measured to a fraction of a degree; such accuracy would be very laudable were the above qualifying adjectives anything more than a matter of individual choice and colour perception. Thus, selecting what was, in his opinion, a "faint yellowish green grey" material, the author had it variously described by others as a "light sage-green," a "greenish fawn," a "dried-pea green," and a "faint olive green"! Clearly, while such vagaries of colour-classification persist, such precise measurements as the above are less justifiable than the determination of the horse-power of an engine to 1 H.P. in 10,000 H.P. from an indicator card.

A REVIEW: COAL.

By "INTERESTED."

Looking back through the accounts of the metropolitan electric supply undertakings, one cannot help thinking what a serious blow would befall these if, from some unforeseen circumstance, the price of coal increased to any appreciable extent. The coal bill alone represents, roughly, about one-third of the total working expenses, and a strike of any duration in certain quarters would mean the total disappearance of profit, and, perhaps, a big pull on the rates for the purpose of meeting the necessary repayments of principal and interest.

Upon the price of coal alone almost hangs the life or death of a station. What chances are there of such an inflated market? Such a rise in price of fuel is quite possible, though highly improbable, but occasionally the improbable shows up as a reality. In this instance so much depends upon the price of coal that those concerned should make

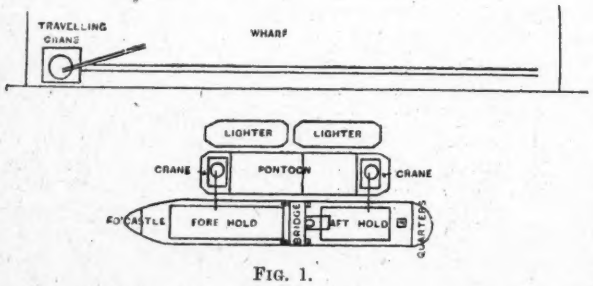


Fig. 1.

every effort now in order to guard against such an event ever occurring. A policy which favours sitting down quietly and waiting for trouble can hardly be termed wise. Look at the number of times this article is handled from the time of reaching the surface to its arrival at the generating station: railborne coal, perhaps, more so than seaborne. There is opportunity here for a little improvement. Of course, the various fuel-saving appliances now on the market (more or less useful) are also a consideration, but, although I should be going over old ground, the question of the users being their own carriers seems to me to be *the* spot where most money is to be saved.

Those stations situated on or near the river bank could combine, or several work together, for the purpose of enabling them to purchase at the pit's mouth, and bring the coal direct from the nearest seaport up river to alongside the wharf or nearest available wharf to the works, without further handling. This arrangement would save lighterage dues from down stream up to the city or suburban wharves, which now have to be met, and which are a big factor in the bargain. Only a shilling or so per ton, but that represents about 8 per cent. to 10 per cent. of the full cost. Say, but three stations came into line in this direction, and the total quantity handled annually is 40,000 tons. That means over £2,000 to consider. Again, being able to place contracts with the colliery-owners themselves for delivery at the nearest seaport, would most likely save the amount of a London agent's commission; say, another 1d. per ton, or £150 per annum. Should the ship, as suggested by me in previous issues, at any time over-run supplies, an opportunity can always be taken of hiring the ship to others for a trip or two. Also, it might be possible to utilise the same ship for the purpose of carrying away the refuse of the district down stream to some dumping ground, or even right out to sea.

This proposed venture being, comparatively speaking, new, some people are liable to be rather sceptical of such an arrangement proving workable or profitable. But look what others are doing. Look what our competitors are doing. Are they running their own tramps at a loss? Without mentioning names, I will give a few details.

About four years ago a certain gas company, whose works are not an hour's row from Putney Bridge, purchased a second-hand steamship and worked her regularly for many months bringing coal from the Tyne and Hartlepool neighbourhood down the coast and up river under many bridges to alongside their works in London. Orders were placed with the collieries direct. The trial proved so successful, even after taking into account the cost of the unloading gear, that a new ship was ordered and built to the particular requirements of the work. Being a much faster vessel than the old one, supplies very quickly became too plentiful, but little difficulty was experienced in finding other people willing to hire the ship for similar purposes.

The enterprise paid better than was even anticipated. Therefore, what is to stop others from going and doing likewise? True, the distance from Wales compared with the Tyne is great, but at the present time coal is brought the same distance by someone, and it cannot be suggested that the someone does the carrying for nothing.

Allow me to run over the arguments which have been used against the proposal. (*a*) Trouble in finding capital for the first cost of ship, pontoon and cranes. (*b*) The difficulties to overcome in order to get local bodies to co-operate in this manner for their mutual benefit. (*c*) Unloading facilities. (*d*) Space for storage.

I will endeavour to answer them in rotation: (*a*) The sum each body would be called upon to find for a start could easily be met out of the funds in hand on the revenue side of accounts, *i.e.*, from accumulated profits or reserve fund. If three works combined, about £7,000 each would be sufficient, and surely that is not an impossible sum to find. There is no need to think of taking up a loan for the purpose. (*b*) Where proper counsel prevails, these difficulties could be smoothed over by some means. They are not so serious as to make it impossible for an amicable settlement to be arrived at, especially if the one big point is kept well to the fore, viz., saving money. The Councillor of to-day can surely be credited with sufficient foresight to enable him to see far enough ahead in order to observe the saving to be effected, and when in possession of detailed estimates, he could be relied on to work in one with another for the common good. (*c*) Unloading arrangements. Well, take a leaf out of our competitors' pocket-book. Provide a large pontoon having a grab crane at either end, which can be moved from wharf to wharf when necessary. A couple of fair-sized lighters would also come in handy perhaps. By mooring the ship in the stream—where there is not depth enough for it to come close in to the side—beside the pontoon, coal could easily be dumped into carts on the wharf, or on the wharf itself, and when the carts are over-run, load up the pontoon for the time being. This arrangement enables the ship to get away again quickly. In fig. 1 a rough sketch is given showing how others manage the business. (*d*) Storage.—"Where there is a will there is a way." That is an old saying, and can be applied in this case. One thousand tons can be stored in nearly every works to-day, and at no time need there be more than 1,500 tons in stock. If there is not storage space now, make room. It will pay.

Not so long ago I saw a plan being prepared of the river

from about London Bridge to Brentford, showing every wharf, creek and dock on the river side, with the approximate dimensions filled in, and a description of the class of goods used or likely to be used at all points. This was intended for a firm in the North, who are reported to be considering the possibility of forming a company for the purpose of carrying goods from around the coast to the river Thames, the ships being so built as to enable them to come right up under bridges to the wharves where barges are to be seen to-day. The scheme may be yet alive, and something more may be heard of the venture in the future, should the proposals prove practicable. This fact alone seems to point out that some business men are alive to the possibilities in this connection.

Standing on one of the bridges under which the present gas companies' ships pass, the various remarks passed to those aboard are highly amusing. By way of diversion here are a few I have heard: "Do you stay out all night in her?" The answer which came smartly back was: "No, we tie her up to a tree at night time." Another was: "Why don't yer call out 'all hot' when yer brings yer old potato-can along?" and, again, "Where are you bound for with that packet, Hong Kong?" These, and similar remarks, are called for by the peculiar appearance of the ships as they pass underneath, as most of the standing gear comes down flush with the deck when passing under bridges, and they look anything but pretty. It is reported that on one occasion a voice hailed from Westminster Bridge like this:—"Captain,—Good luck to you. Business people should have done this years ago"; and, upon looking back, the head and shoulders showing above the parapet proved to belong to one of the right hon. gentlemen in the present Cabinet.

Anyway, enough has been said to induce those really concerned in this matter to seriously think over the subject; and, if I might suggest going a step in the right direction, perhaps the gas folk would not be above giving a little information from actual trial, if approached from the right direction.

REVIEWS.

Telephonology. By H. R. Van Deventer. New York: McGraw-Hill Book Co. London: Hill Publishing Co. Price 17s. net.

Of the many books upon which the present reviewer has been called upon from time to time to express an opinion as to the merits or otherwise, he cannot recall one which presented as much difficulty as this one does. It contains a vast amount of matter which probably cannot be met with in any other one text-book; matter which might only be found by careful search amongst the files of the technical Press, both English and American. Matter, too, which although of doubtful value to the British telephone engineer, might upon occasion prove useful to him could he lay his hands upon it promptly. Yet the reviewer looks aghast at the diction in which that matter is expressed. Of course, every reader is more or less familiar with the peculiar liberties taken with the English language on the other side of the Atlantic, especially in scientific or engineering subjects, liberties which, if one may use the term, may perhaps best be described as scientific slang, expressions of doubtful origin, for the use of which justification is still more doubtful. Nevertheless, we have become slightly accustomed to see them in the American periodicals, but surely they are horribly out of place in a text-book. This is not the place, of course, in which to indulge in a tirade against the abuse of the English language; at the same time it gives one pause to read in a text-book a sentence like the following:—". . . every so often the Exchange manager persuades himself, or someone does it for him, that this time the proposition has really been solved, and into a number of these instruments goes his *hard earned*, he to discover only too soon that it is a case of 'stung again by Heck.'" Again, "If she (the operator) be one of the genus diligent, the operator will sever the connection . . . . materially assisting the subscriber and enlarging his profanic vocabulary." Further on we read, "the troubleman . . . gets a screwdriver or pliers across the right springs, he most assuredly will be possessed of the idea that the irascible and implacable brute—that incarnate thunderbolt—that monster of the upper deck—an old horny-headed ram—has struck him fair and hard, at which he will inform you that you may . . . . . put out the placard for another bug shooter." It is true that the author is here quoting from a journal, but in making use of the expressions he makes them his own, not, we think, enhancing the dignity of his book.

The book contains over 500 pages, devoted to first principles, signalling and speaking equipment, magneto exchanges of several types, batteries — including secondary cells, charging methods and appliances, outdoor construction (American practice), common battery equipment, testing methods and equipment, party line systems, automatic exchanges and wireless telephony. Among the testing information is given some useful matter dealing with the testing and efficiency comparisons of many items of exchange equipment; there is also a fairly sound discussion of the essentials of telephone theory.

The volume seems to have been produced largely for a class of person which, at any rate at present, does not, we think, exist very largely in this country, that is, the exchange manager who has to do, or be responsible for, his own engineering work. To the operative and traffic staffs in an English organisation it may probably be interesting, but doubtless too technical to be valuable, whereas, on the other hand, it will be somewhat too unscientific for those dealing with the purely engineering aspect of such work. To either class it does not seem to be worth the price charged for it, although it would be useful to have the book within reach. —R.M.H.

The Telegraphic Transmission of Photographs. By T. Thorne Baker. London: Constable & Co. Price 2s. 6d.

This is a subject which has many times been treated of or referred to both in text-books and in the scientific Press, but it does not appear to have had previously a text-book or a volume devoted solely to itself. It may be that this volume shows that yet another subject is to be added to the many with which the members of the electrical engineering profession are supposed to be more or less conversant. The author describes the most recent developments which have taken place in his subject, showing what measure of success has attended his own experiments and those of contemporaries, experiments which have brought what was previously scarcely more than a laboratory system into the region of practical use. He refers to the history of previous attempts made to solve the problem only so far as such attempts have a bearing on the practical system which he describes. Of course the transmission of pictures along wires is such an attractive one that it appealed to many inventors, even in the earliest days of electric telegraphy—in fact, we may say that one of the earliest telegraphs of practical utility was a step in this direction, involving, as it did, the transmission of certain designs—arbitrary representations of a code—from one place to another, and, strange to say, the method then adopted, viz., the decomposition, by means of electric currents, of chemicals in suitably prepared paper, has not been despised by many of the, may we say, *pictorial* electricians of later date, even by Mr. Thorne Baker himself.

The book is very concise, and of course most interesting, but it is difficult to say whether it is written to the layman or to the scientist. If the former, then the mathematics (which are not always convincing) were better left out. If, on the other hand, the author wished to approach the electrician, he is not mathematical enough. A casual reader would, in fact, wonder not unjustly whether Mr. Thorne Baker is a scientist with journalistic tendencies, or a *bonâ fide* journalist dropping into science after the fashion of the immortal Wegg. A book dealing with a scientific subject must either be popular or strictly professional; the two aspects cannot be combined.

The author opens with a description of the Bakewell system with its relief image, make-and-break transmitter and chemical receiver, the translucent image and selenium cell transmitter systems of Bidwell, Ayrton and Perry, and

Korn; progresses by easy stages to the telautograph (now in practical existence as the telewriter, described in these pages recently), and thence to systems where the variation in conductivity of photographically prepared films is employed for transmission. Different types of receivers are fully described. A large amount of space is devoted to Prof. Korn's telautograph and many examples of its results are reproduced. Mr. Thorne Baker then goes on to describe his own system (the Telectograph), which, as he says, is really a modification or refinement of the original Bakewell system. His difficulties are described, and many examples are given with diagrams and illustrations. In this connection it seems that the author might have been spared much time had he had the assistance of a practical telegraph engineer—one conversant with systems of high-speed telegraphy and with the facts governing the transmission of waves or impulses over long aerial or submarine lines. A special difficulty in avoiding distortion to his pictures seems to lie in this direction, as he has had trouble in getting a wire to carry the picture-producing waves without distortion; but it is gathered—we may not be quite correct—that his maximum speed of wave transmission does not quite approach the speed at which Wheatstone signals are actually transmitted. High-speed telegraphy presented exactly the same problems, and such have been successfully got over by the adoption of some, what one may call, little dodges now well known to the telegraph engineer.

However, the book amply repays reading, and Mr. Thorne Baker deserves congratulation for placing the results of his labours before the public. So, too, do the proprietors of the *Daily Mirror*, who apparently have done a lot to further Mr. Thorne Baker's experiments.—R.M.H.

General Foundry Practice. By William Roxburgh. London: Constable & Co., Ltd. Price 10s. 6d. net.

The somewhat lengthy sub-title of this book describes its purpose. It is "a treatise on general iron founding, job loam practice, moulding and casting of the finer metals, practical metallurgy in the foundry, and pattern-making from a moulder's point of view." The author has had many years' experience as a moulder and foundry manager, and he claims that such a book as is here presented is needed. The inducement is held out (in the preface) that "the whole work is light and practical reading," and yet the happy purchaser will obtain "the greatest amount of information on foundry methods, materials and metals, with the least possible study." Which has a close resemblance to the advertisements for patent medicines! Despite these blemishes, the book is distinctly good. There are three main divisions: (1) General ironfounding; (2) Jobbing loam practice; (3) Moulding and casting the finer metals. Tacked on to the end of Division 3 are useful articles on practical metallurgy in the foundry, general pattern-making from a moulder's point of view, foundry ovens and their construction, fuels, and foundry tools. There are 161 illustrations, many of them excellent, but here and there we come across one that could be improved. At times the phraseology is quaint, as, for example, a sentence on page 51, which runs, "I have never seen it necessary, even in a 12-ft. diameter 'spur wheel,' and, say, seven tons' weight, in cast-iron, to split in more places than between two opposite arms; but were anyone to attempt even a much smaller diameter in steel, such would more or less end in failure, if split in only two places, through the casting concaving itself out of truth, thus making it impossible to gear with its pinion." The author acknowledges his thanks to a lecturer in metallurgy in the University of Birmingham for assistance in editing this work. To be quite frank, we rather expected better results from collaboration with a member of the staff of that centre of higher education.

There is, however, much sound common-sense, besides useful technical information, in this book. The author talks shrewdly about men, and gives good advice concerning the selection of a foreman and similar matters. He has either kept copious notes or has an excellent memory, for he frequently gives the reader the advantage of his own experience. The pattern-maker and works manager should read pages 25 and 26 for some home truths. One of the most interesting sections of the book is that which deals with casting jacketed cylinders. The reviewer worked for some months in a foundry in which large marine engine cylinders were cast, and the author of this book on foundry practice has explained many obscure points. The details concerning the moulding of a Corliss cylinder in dry sand, and of a 36-in. cylinder liner in loam, are excellent.

The subject of aluminium founding, is, of course, somewhat specialised, but the author has evidently had experience in the work, or has obtained the full benefit for the reader of someone else's experience. The present writer has always heard that aluminium yellow brass is a difficult material to cast. The author gives reasons for failures, one of which is curiously expressed as "undue" temperature.

Some few months ago the manager of an engineering repair works, employing about 80 men, requested the writer to recommend him a book on foundry practice, as he found that part of his work the least satisfactory. The reply given was "there is a splendid opportunity for someone with considerable experience to write such a book." While it is not suggested that the volume before us is by any means up to the standard it was hoped would be reached, yet it is worth mentioning that a letter has been sent to the above inquirer strongly recommending him to purchase this new treatise.

We know, and respect, the practical type of man to which the author obviously belongs. He is an individual that can usually *do* a thing much more easily than he can *write* about it. The author of "General Foundry Practice" has recorded his knowledge thoroughly, if somewhat quaintly. To him, there is little or no blame for the defects of the book; he evidently had the common-sense to see that it would be improved by collaboration with a University man. Unfortunately, it is the latter who seems to have failed in his work. However, we can sincerely recommend the treatise before us to those interested in the subject of foundry practice.

The Principles and Practice of Ironfounding. By E. L. Rhead. Manchester: The Scientific Publishing Co. Price 7s. 6d. net.

The products of the ironfoundry can only be satisfactory when skill and ingenuity have been applied in all the details, from design to the finished article, including the following stages:—

1. Suitable application by the engineer.
2. Correct design, in detail, by the draughtsman, who should be well grounded in the art of moulding and the most suitable forms for cast products.
3. Proper construction of the pattern by the pattern-maker, to enable the moulder to make the casting in the most expeditious and suitable manner.
4. The preparation of the mould and cores, from the most efficiently graded and selected class of sand, to ensure the exact and perfect reproduction of the pattern, free from the accumulations of scum, sand and blow-holes due to want of proper venting by the moulder.
5. The arranging of the most suitable composition by the foundryman, by adjusting the mixture of irons to give the necessary fluidity, or other required conditions, to cause the product to comply with the engineer's specification and tests.

Obviously it is no simple task to present in a single volume technical information which shall at once be of value to all the individuals engaged in the various departments referred to, but Mr. Rhead's work will be found an excellent guide and reference to all engaged in the application and production of iron castings.

Covering over 500 pages, well illustrated with clear line and process blocks, the work is divided into 18 chapters, with an appendix of useful data; but as each chapter includes such a large number of technical details, it is almost impossible to do justice to the book in the space of a review.

Being of a thoroughly practical character, clearly and simply written, the book will be appreciated by the workmen in the pattern shop and foundry, as well as the student and the engineer.

The Practical Telephone Handbook. By J. Poole. Fourth Edition. London : Whittaker & Co. Price 6s.

This is a revision of one of the series of well-known practical books, for which Messrs. Whittaker & Co. deserve the thanks of many members of the electrical profession. Mr. Poole not only knows his subject both theoretically and practically, but he is able to place his knowledge in a very concise and clear way before his readers. The previous edition was amply commended in these columns, and for this edition little need be added in further commendation. However, with such a progressive science as telephony, and in consideration of the enormous developments which have taken place during recent years, the author's revision was amply justified. We observe that very exhaustive revision has taken place in the chapters relating to common battery working, junction line working, open and underground line construction, the theory of telephonic transmission and the loading, by means of artificial inductance, of telephone circuits. The author has also added four new chapters, which include the subjects of development studies, wireless telephony and the latest post office practice, both as regards local subscriber's exchanges and trunk exchanges. He has drawn freely upon information published in contemporary journals, and therefore his book, in this edition especially, is most comprehensive, and, at the same time, entirely free from padding. It should be comforting to the English engineer to be in a position to consult an English work on the subject. So many text-books come from across the Atlantic, and, although the information contained in them is good, no end of confusion may rise in the already more or less over-burdened mind of the telephone engineer, by reason of the peculiar nomenclature and phraseology, without which our friends on the other side would doubtless be unable to exist. The reviewer confesses to no little insular pride when, on reading Mr. Poole's work, it becomes evident that the telephone systems of the Post Office and National Telephone Co. are not so very many leagues behind trans-Atlantic practice as the disparaging remarks so frequently made by the carping critic would lead one to imagine. The author's chapter on Automatic Exchanges is well worthy of perusal now that English engineers, having awaited with typical caution the results of American installations, are beginning to consider the suitability of these for our own needs.

We can, therefore, with confidence, recommend this book to all who have, in any way, actual connection with the planning, working or maintenance of a telephone exchange system. It should also be available on the shelves of all who have to do teaching work on this subject for the various science classes.—R. M. H.

PROTECTIVE SHIELDS FOR H.T. WORK.

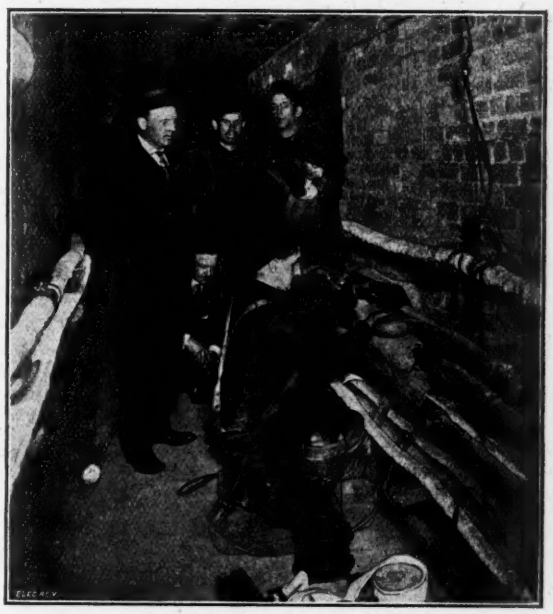
A device which is being introduced into this country, and which is extensively used on overhead and underground mains work in the States, is the Linemen Protector Shield, which consists of a rubber trough, which can be clipped over a live wire in order to shield it from the man working in the vicinity. Although we have not much use for such a shield in this country, owing to the scarcity of overhead wires and the practice of avoiding interference with live networks generally, whether overhead or underground, yet there are, no doubt, occasions when such a device would be useful in this country, and its good features should appeal more particularly to the engineer in the Colonies.

As a matter of fact, the largest users of the shield in the States are the light and power corporations in cities like New York, Philadelphia, Chicago, Baltimore, &c., where underground networks are the rule.

One of our views shows a gang at work in a cable subway, where a cable splicer is working on one phase of a three-phase circuit. The other phases are shielded with protectors ; the splicer is also standing on one and another one protects him from contact with the lead cable sheathing.

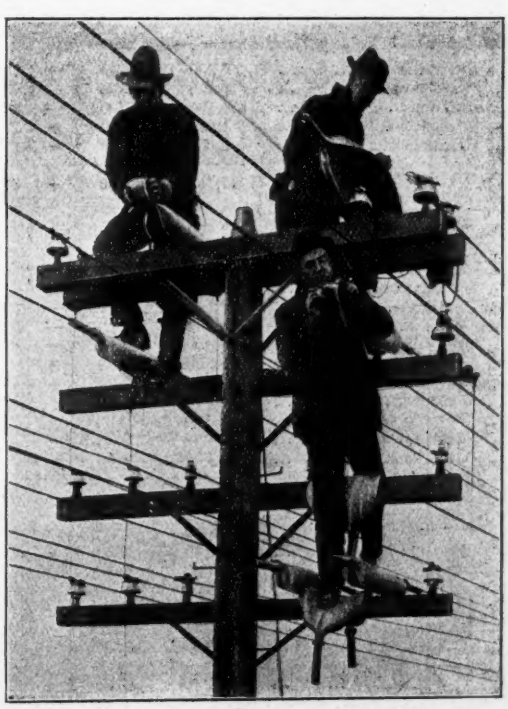
The large American cities mentioned above have each over 100 shields in use, six being the usual number on each repair or construction wagon. The shields are in use in many central stations, as they form excellent aprons, by means of which a man can lie across the bus-bars and often carry out some work, which would otherwise be dangerous.

All the shields are carefully tested at 30,000 volts before leaving the factory, so that providing they are used intelligently there is no risk in using them.



Protective Shields in use in Cable Subway

Some 200 American concerns are now using this device, to manufacture which arrangements are being made both in this country and Australia, as patents have been taken out in both cases.



Protective Shields used on Live Overhead Line.

The shields are being supplied by the Linemen Protector Co., of Detroit, Michigan, whose representative, Mr. E. W. Stevenson, is at present in this country (temporary address, 12, Union Court, Old Broad Street).

GERMANY'S EXPORTS OF ELECTRICAL GOODS DURING THE FIRST HALF OF 1910.

The following statement, showing the quantity of electrical goods of various kinds exported from Germany during the six months ended June 30th, 1910, is taken from the recently issued official statistics; the figures for the corresponding period of 1909 have been given for purposes of comparison, increases and decreases being shown:—

In double centners (220·4 lb.).

	1909.	1910.	Increase or decrease.
Dynamos, Motors, Converters, Transformers and Choking Coils, up to 5 Double Centners weight.—			
To Austria-Hungary ...	3,500	5,000	+ 1,500
„ Great Britain ...	1,200	1,700	+ 500
„ Belgium	1,700	2,700	+ 1,000
„ Italy	4,700	4,500	— 200
„ Netherlands	1,200	2,100	+ 900
„ Russia in Europe ...	1,600	2,800	+ 1,200
„ Spain	1,000	1,400	+ 400
„ Other countries ...	8,200	13,100	+ 4,900
Total	23,100	33,300	+10,200
Ditto, over 5 Double Centners in weight.—			
To France	7,400	9,400	+ 2,000
„ Switzerland	800	2,100	+ 1,300
„ Netherlands	3,700	4,400	+ 700
„ Belgium	5,600	7,200	+ 1,600
„ Great Britain	5,100	4,500	— 600
„ Austria-Hungary ...	4,400	3,400	— 1,000
„ Italy	14,000	9,200	— 4,800
„ Russia in Europe ...	5,400	3,200	— 2,200
„ Norway...	1,700	2,700	+ 1,000
„ Spain	7,900	3,400	— 4,500
„ Argentina	3,200	4,700	+ 1,500
„ Japan	6,100	3,100	— 3,000
„ British S. Africa ...	4,200	30,300	+26,100
„ Mexico	1,200	3,100	+ 1,900
„ Other countries ...	11,300	13,000	+ 1,700
Total	82,000	103,700	+21,700
Rotors and Commutators.—			
To Great Britain	1,600	3,000	+ 1,400
„ Austria-Hungary ...	1,100	2,700	+ 1,600
„ Italy	1,400	2,500	+ 1,100
„ Russia in Europe ...	1,400	1,900	+ 500
„ Other countries ...	5,500	8,900	+ 3,400
Total	11,000	19,000	+ 8,000
Accumulators and Plates, without horn or rubber, &c.—			
To Denmark	3,900	2,400	— 1,500
„ Netherlands	2,500	900	— 1,600
„ Sweden	4,100	3,600	— 500
„ Argentine	1,900	2,000	+ 100
„ Other countries ...	5,000	8,800	+ 3,800
Total	17,400	17,700	+ 300
Cable.—			
To Netherlands	13,600	16,000	+ 2,400
„ Belgium	17,600	19,100	+ 1,500
„ Great Britain	6,700	4,800	— 1,900
„ Denmark	9,100	2,700	— 6,400
„ Sweden...	16,400	12,700	— 3,700
„ Spain	3,600	900	— 2,700
„ Argentina	17,800	21,600	+ 3,800
„ Japan	2,300	13,300	+11,000
„ Uruguay	700	1,800	+ 1,100
„ Italy	5,800	4,800	— 1,000
„ Norway	3,100	4,900	+ 1,800
„ Brazil	2,000	2,600	+ 600
„ Other countries ...	71,000	53,800	—17,200
Total	169,700	159,000	—10,700
Arc Lamps.—			
To Belgium	200	300	+ 100
„ Russia in Europe ...	300	400	+ 100
„ Great Britain	350	350	—
„ Argentina	260	580	+ 320
„ U.S. America	390	520	+ 130
„ Other countries ...	1,740	1,580	— 160
Total	3,240	3,730	+ 490
Incandescent Lamps.—			
To Austria-Hungary ...	340	780	+ 440
„ Italy	340	580	+ 240
„ Great Britain	1,470	2,620	+ 1,150
„ France	520	680	+ 160
„ Russia in Europe ...	640	900	+ 260
„ Other countries ...	2,250	3,950	+ 1,700
Total	5,560	9,510	+ 3,950

In double centners (220·4 lb.).

	1909.	1910.	Increase or decrease.
Telegraph and Telephone Material.—			
To France	830	470	— 360
„ Great Britain	1,100	1,080	— 20
„ Italy	600	370	— 230
„ Austria-Hungary ...	600	410	— 190
„ Switzerland	410	270	— 140
„ Belgium	1,400	950	— 450
„ Netherlands	370	480	+ 110
„ Russia in Europe ...	610	550	— 60
„ Denmark	350	300	— 50
„ Other countries ...	1,930	2,290	+ 360
Total	8,200	7,170	— 1,030
Electrical Apparatus for Lighting, Power, &c.—			
To Belgium	2,500	3,000	+ 500
„ Great Britain	2,300	2,100	— 200
„ Netherlands	1,800	1,800	—
„ Spain	2,800	2,300	— 500
„ Switzerland	1,200	1,800	+ 600
„ Italy	3,800	4,200	+ 400
„ Austria-Hungary ...	3,200	3,800	+ 600
„ Russia in Europe ...	3,900	3,800	— 100
„ Sweden	1,100	1,400	+ 300
„ Argentine	1,800	4,200	+ 2,400
„ Chile	660	690	+ 30
„ Japan	870	500	— 370
„ Uruguay	320	440	+ 120
„ British S. Africa ...	620	7,300	+ 6,680
„ Other countries ...	7,130	8,970	+ 1,840
Total	34,000	46,300	+12,300
Electrical Measuring and Recording Instruments.—			
To Great Britain	340	290	— 50
„ Italy	900	1,100	+ 200
„ Austria-Hungary ...	900	1,200	+ 300
„ Switzerland	240	430	+ 190
„ Denmark	140	310	+ 170
„ Sweden	210	270	+ 60
„ Russia in Europe ...	610	1,000	+ 390
„ Spain	330	260	— 70
„ Argentine	320	330	+ 10
„ Other countries ...	1,610	1,910	+ 300
Total	5,600	7,100	+ 1,500
Carbons, Brushes, &c.—			
To France	800	1,300	+ 500
„ Switzerland	500	1,000	+ 500
„ Austria-Hungary ...	1,200	1,600	+ 400
„ U.S. America	5,500	4,000	— 1,500
„ Great Britain	5,000	7,900	+ 2,900
„ Italy	2,100	2,600	+ 500
„ Other countries ...	8,400	9,100	+ 700
Total	23,500	27,500	+ 4,000

The Engineering Exhibition at Olympia.—Among the exhibits at Olympia is one by Messrs. Babcock & Wilcox, Ltd., showing one of their patent water-tube boiler (portable type) complete with iron casing, having 955 sq. ft. heating surface, constructed for 200 lb. working pressure, and fitted with usual mountings and having one of their steel stayed chimneys. The boiler is placed in the yard at Hammersmith Road entrance, and will supply steam for driving machinery in the Exhibition. In addition to the foregoing Messrs. Babcock & Wilcox also show on their stall, Nos. 27 and 63, a model of seagoing torpedo boat destroyer (speed 30 knots) fitted with White Forster water-tube boilers, for which the firm are the sole licensees from Messrs. J. Samuel White and Co., Ltd., of East Cowes, I. of W. They further exhibit the following:—A model of water-tube boiler (marine type) as installed in the various Navies and in the mercantile marine, and of which they have supplied some 1,961,000 H.P. A model of water-tube boiler (standard land type) as supplied for all industries, and of which there are some 7,700,000 H.P. installed. This boiler is fitted with one of their patent steam superheaters. A model patent mechanical chain grate stoker for burning bituminous coal smokelessly. A model of Lassen & Hjort water purifier for eliminating the hardness from feed water for boilers, &c., such as they are handling under licence from the patentees. A collection of wrought-steel steam piping with wrought-steel flanges, as manufactured by the firm. Samples of wrought headers used in the construction of Babcock boilers with pieces of tubes expanded therein. Collection of turbine tube cleaners for removing scale from the inside of boiler, economiser and other tubes; also some sample parts of their coal-conveying machinery.

TRADE STATISTICS OF SOUTH AFRICA.

The following statement, showing the imports of electrical and similar goods into British South Africa during the year 1909, has been taken from the recently issued official trade statistics. The figures for 1908 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1908.	1909.	Increase or decrease.
	£	£	£
Detonators.—			
From United Kingdom ...	24,000	19,000	— 5,000
„ Belgium	2,000	—	— 2,000
„ Germany	10,000	10,000	—
„ Norway	1,000	—	— 1,000
Total ...	37,000	29,000	— 8,000
Fuses.—			
From United Kingdom ...	44,000	55,000	+ 11,000
„ Germany	54,000	52,000	— 2,000
Total ...	98,000	107,000	+ 9,000
Asbestos manufactures.—			
From United Kingdom ...	—	300	+ 300
„ Switzerland	400	—	— 400
Total ...	400	300	— 100
Brass manufactures.—			
From United Kingdom ...	11,000	15,000	+ 4,000
„ Germany	1,000	1,000	—
„ Other countries ...	1,000	1,000	—
Total ...	13,000	17,000	+ 4,000
Copper, plate and sheet.—			
From United Kingdom ...	8,000	4,000	— 4,000
„ Germany	1,000	1,000	—
Total ...	9,000	5,000	— 4,000
Copper manufactures.—			
From United Kingdom ...	3,000	3,000	—
„ Other countries ...	—	1,000	+ 1,000
Total ...	3,000	4,000	+ 1,000
Electrical cable and wire.—			
From United Kingdom ...	63,000	120,000	+ 57,000
„ Germany	47,000	79,000	+ 32,000
„ United States	1,000	5,000	+ 4,000
Total ...	111,000	204,000	+ 93,000
Electrical fittings, including posts.—			
From United Kingdom ...	41,000	66,000	+ 25,000
„ Germany	43,000	84,000	+ 41,000
„ Holland	1,000	3,000	+ 2,000
„ United States	10,000	15,000	+ 5,000
„ Other countries ...	2,000	2,000	—
Total ...	97,000	170,000	+ 73,000
India-rubber of all kinds.—			
From United Kingdom ...	22,000	28,000	+ 6,000
„ Germany	1,000	3,000	+ 2,000
„ United States	4,000	3,000	— 1,000
Total ...	27,000	34,000	+ 7,000
Lamps and lampware.—			
From United Kingdom ...	12,000	14,000	+ 2,000
„ Germany	12,000	12,000	—
„ Sweden	1,000	1,000	—
„ United States	6,000	7,000	+ 1,000
Total ...	31,000	34,000	+ 3,000
Machine bands and belting.—			
From United Kingdom ...	87,000	103,000	+ 16,000
„ United States	15,000	27,000	+ 12,000
„ Other countries ...	1,000	1,000	—
Total ...	103,000	131,000	+ 28,000
Electrical machinery.—			
From United Kingdom ...	123,000	111,000	— 12,000
„ Germany	108,000	103,000	— 5,000
„ United States	36,000	45,000	+ 9,000
„ Other countries ...	2,000	2,000	—
Total ...	269,000	261,000	— 8,000
Cranes, elevators and lifts.—			
From United Kingdom ...	11,000	19,000	+ 8,000
„ United States	3,000	2,000	— 1,000
„ Other countries ...	1,000	—	— 1,000
Total ...	15,000	21,000	+ 6,000
Mining machinery.—			
From United Kingdom ...	516,000	673,000	+157,000
„ Germany	94,000	114,000	+ 20,000
„ United States	98,000	161,000	+ 63,000
„ Other countries ...	7,000	10,000	+ 3,000
Total ...	715,000	958,000	+243,000
Machinery not specially mentioned (other than agricultural, manufacturing, &c.).—			
From United Kingdom ...	262,000	301,000	+ 39,000
„ Germany	20,000	33,000	+ 13,000
„ United States	22,000	23,000	+ 1,000
„ Other countries ...	4,000	4,000	—
Total ...	308,000	361,000	+ 53,000
Railway rails.—			
From United Kingdom ...	15,000	107,000	+ 92,000
„ Belgium	—	44,000	+ 44,000
„ Germany	14,000	47,000	+ 33,000
„ United States	—	1,000	+ 1,000
Total ...	29,000	199,000	+170,000
Telegraph and telephone material.—			
From United Kingdom ...	3,000	12,000	+ 9,000
„ Germany	—	1,000	+ 1,000
„ Sweden	1,000	2,000	+ 1,000
Total ...	4,000	15,000	+ 11,000
Tramway rails.—			
From United Kingdom ...	1,000	2,000	+ 1,000
„ Germany	23,000	16,000	— 7,000
„ United States	2,000	2,000	—
Total ...	26,000	20,000	— 6,000
Tramway rolling-stock.—			
From United Kingdom ...	5,000	4,000	— 1,000
„ Germany	4,000	2,000	— 2,000
„ United States	—	1,000	+ 1,000
Total ...	9,000	7,000	— 2,000
Other tramway materials.—			
From United Kingdom ...	6,000	3,000	— 3,000
„ Germany	5,000	10,000	+ 5,000
„ United States	1,000	1,000	—
Total ...	12,000	14,000	+ 2,000

Ship Propulsion.—We gather from the *Mechanical Engineer* that Messrs. McLaren Bros., of Dumbarton, are launching a 54-ft. vessel to the order of Mavor & Coulson, Ltd., which will be used to test the value of a marine gas plant in conjunction with Mr. Mavor's system of electric transmission of power to the propellor. It is interesting to note that Messrs. Eltringham, of South Shields, are building a 120-ft. vessel for the Holzapfel Marine Gas Power Syndicate, which will be equipped with a set of Hindley six-cylinder high-speed gas engines, the necessary producers, scrubbers, &c., and with a hydraulic transmission system to the propellor, consisting of a centrifugal pump delivering water to "astern" or "ahead" turbines coupled to the propellor shaft.

New Alloys.—Sulphalium.—The Stirling Metal Co., of Cyclops Works, Millwall, E., are introducing a special aluminium alloy under the above name, with a melting-point slightly higher than aluminium (about 1,200° F.) and weighing about 2½ per cent. more than pure aluminium. The alloy contains no zinc. The tensile strength of sand castings varies from about 8 to 10 tons per sq. in., and they are readily machined or filed.

Duralumin.—According to the daily Press, Messrs. Vickers, Sons & Maxim will place a new alloy, called Duralumin, on the market next month. The new alloy is stated to be slightly heavier than pure aluminium, and as strong as steel; it can be rolled, drawn, stamped, or forged, is less corrodable than other high aluminium alloys, and about one-third the weight of brass. The alloy is patented throughout the world.

Synagogue Lighting.—With reference to our note on the lighting of Bradford Synagogue, we learn that Messrs. E. P. Allam & Co. a short time ago installed Osram lamps throughout the Bayswater Synagogue—one of the largest buildings of this class in the country. The installation, which has been a complete success, both as to effective illumination and as to saving in current compared with the old carbon-filament lamps, consists of 243 Osrams, all of 16 c.p. on 50 volts. The firm named installed a bank of transformers to reduce the pressure from the 200-volt service of the Metropolitan Electric Supply Co.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

AUSTRALIAN COMMONWEALTH.—The following decisions as regards the application of the tariff to certain electrical goods have been made by the Customs authorities :—

Electrical appliances :

Cartons, paper, printed, enclosing zinc boxes used in the manufacture of dry cells :

Paper cartons, printed	6d. per lb., or 35 % ad val. (whichever rate returns the higher duty).
Zinc boxes	10 % ad val.
Fuse-box, being one fuse in box	Free.
Fish-bolts for railways or tramways	10 % ad val.
Portable cranes, electric, consisting of motor, controller, crane and truck (on the whole) ...	20 % "
Fish-plates for railways and tramways	10 % "
Tie plates and rods for railways and tramways ...	" "

NEW ZEALAND.—The New Zealand Customs authorities have decided that motor tramcars imported into New Zealand, if of British manufacture, shall be dutiable at the rate of 20 per cent. ad val.

N.B.—A surtax of 2½ per cent. of the amount of duty payable at this rate is also levied.

ECUADOR.—The Government of the Republic of Ecuador have decided to impose a surtax of 10 per cent. on the duties levied on all imported goods, with the exception of (1) comestibles, (2) cotton stuffs paying 30 cents per kg. or less, and (3) tools and implements for agriculture and industry.

NETHERLANDS.—The Dutch Government have decided that electric tramrail filing machines driven exclusively by mechanical power, and for removing inequalities of the surface of tramrails, shall be admitted into the Netherlands free of duty.

FRANCE.—The French Customs Authorities have decided that porcelain insulators mounted on an iron or steel stand shall be dutiable as follows :—

	Francs per 100 kg.
If they can be separated, the insulators as :	
Insulators, bell-shaped, of 90 mm. dia. or less	10
" " other	15
The stands as :	
Small articles of iron or steel	10

The decisions have also been given that for tariff purposes :—"Coils of insulated metallic wire" are understood to be of wire having an insulation, such as wire surrounded by a covering of textile threads, by a sheath of ribbon, trimming or tissue, by an insulating coating with a base of india-rubber or gutta-percha or any other material except uncovered (bare) metallic wires, set in a bobbin of porcelain, glass or pottery ; and that fly-wheels for machines include power or regulation fly-wheels excluding crank fly-wheels, driving pulleys or hand-gear, which make an integral part of the apparatus when they are imported with the same.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,583. "Improvements in and relating to synchronous motors." LANCASHIRE DYNAMO AND MOTOR CO., LTD., A. P. WOOD and R. S. MCLEOD. August 22nd. (Complete.)

19,593. "Apparatus and process for making wire electrolytically." W. E. GIBBS. (Date applied for under Sec. 91 of the Act, September 4th, 1909, being date of application in United States.) August 22nd. (Complete.)

19,594. "Apparatus and process for annealing wire." W. E. GIBBS. (Date applied for under Sec. 91 of the Act, September 4th, 1909, being date of application in United States.) August 22nd. (Complete.)

19,600. "Multi-tubular positive for electric batteries." SOCIETE DES ETABLISSEMENTS SAGE BINE ET CIE. (Date applied for under Sec. 91 of the Act, June 25th, 1910, being date of application in France.) August 22nd. (Complete.)

19,625. "Method of and apparatus for reversing internal-combustion engines with electric ignition." O. GRAVDAHL. (Date applied for under Sec. 91 of the Act, September 2nd, 1909, being date of application in Norway.) August 22nd. (Complete.)

19,701. "Means for electrically transmitting orders or signals for indicating their nature and the points of transmission." H. QUERTIER. August 23rd. (Complete.)

19,703. "Electrical transmitting, printing, indicating and recording apparatus." H. QUERTIER. August 23rd. (Complete.)

19,729. "Improvements in secondary batteries and in miners' lamps for use therewith." D. W. JOHN and J. H. BERRY. August 24th.

19,773. "Improvements in or relating to the electrolytic production of antimony." M. RUTHENBERG. August 24th.

19,786. "Improvements in and relating to electromagnetic clutches." K. MIRAM and L. SEIDEL. (Date applied for under Sec. 91 of the Act, February 14th, 1910, being date of application in Germany.) August 24th. (Complete.)

19,804. "Electric furnaces." J. H. REID. August 24th. (Complete.

19,805. "Means for regulating electrodes in electric furnaces." J. H. REID. August 24th. (Complete.)

19,826. "Improvements in or relating to electric incandescent lampholders." C. D. COPLAND. August 25th.

19,851. "Improvements relating to electrical cut-outs." A. C. REYROLLE and A. REYROLLE & Co., LTD. August 25th.

19,866. "Improved process for the manufacture of fireproof electrically conductive materials." GEBRUDER SIEMENS & Co. (Date applied for under Sec. 91 of the Act, October 4th, 1909, being date of application in Germany. August 25th. (Complete.)

19,910. "Improvements in automatic circuit-breakers." F. BROWN. August 26th.

19,914. "Metal-filament electric lamps." N. STRAUSSLER. August 26th.

19,930. "Improvements relating to a combined fuse-box and switch for electric circuits." P. DRUSEIDT. August 26th. (Complete.)

19,932. "Flexible protector and grip for use with cables conducting electricity." P. P. WHEELWRIGHT and E. MOXON. August 26th.

19,940. "Improvements relating to electric ignition apparatus for internal-combustion engines." J. POLKEY. August 26th.

19,952. "Improvements in and relating to electromagnetic clutches." K. MIRAM and L. SEIDEL. (Application for Patent of Addition to No. 19,786/10. Date applied for under Sec. 91 of the Act, July 25th, 1910, being date of application in Germany.) August 26th. (Complete.)

19,955. "Improvements in transmitters for use in wireless telegraphy." J. G. BALSILLIE and BRITISH RADIO-TELEGRAPH AND TELEPHONE CO., LTD. August 26th.

19,970. "Improvements in apparatus for electrically detecting railway points." SIEMENS BROS. & Co., LTD., and L. DE M. G. FERREIRA. August 26th. (Complete.)

19,971. "Improvements in electro-magnets with removable cores." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) August 26th. (Complete.)

19,989. "Improvements in and relating to electric lampholders." N. MCLEAN. August 27th.

19,993. "Electric resistance." M. KALLMANN. (Date applied for under Sec. 91 of the Act, August 31st, 1909, being date of application in Germany.) August 27th. (Complete.)

20,004. "Improved construction of sparking or ignition plug." H. E. ASHDOWN. August 27th.

20,009. "Electric-operated water-boiling machine." J. A. BROOKS. August 27th.

20,039. "Improvements relating to electrically-heated flat irons." BRITISH THOMSON-HOUSTON CO., LTD., and C. R. D'ARCY. August 27th.

20,040. "Improvements in sockets for fixing electric bulbs." SOCIETE DITE ETABLISSEMENTS PAZ AND SILVA. (Date applied for under Sec. 91 of the Act, June 28th, 1910, being date of application in France.) August 27th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford ; price, post free, 9d. (in stamps).

1909.

ALTERNATING ELECTRIC CURRENT COMMUTATOR MACHINES HAVING TWO WORKING AND TWO EXCITER WINDINGS. Allgemeine Elektricitäts Ges. 10,685. May 5th. (Date applied for under International Convention, May 6th, 1908.)

AUTOMATIC REGULATION OF DYNAMO-ELECTRIC MACHINES. H. M. Taylor and R. H. Scotson. 17,739. July 30th.

ELECTRIC TELEGRAPHY. S. G. Brown, W. Judd and A. R. Hardie. 17,774. July 30th.

ELECTRIC DRIVING MECHANISM FOR CLOCKWORK. L. Webber, F. C. Webber and H. V. Webber. 17,888. August 3rd.

ELECTRIC SWITCHES APPLICABLE FOR FLASH-LIGHTING. C. H. Jukes Browne. 17,895. August 3rd. (Cognate application, No. 1,276 of 1910.)

Callender's First Annual Sports.—Although the employés of Callender's Cable and Construction Co., Ltd., have boasted an athletic club for five years, it was only on Saturday, August 27th, that they essayed a public meeting, which was held on the club grounds at the works at Belvedere. The weather was propitious ; there was a fair amount of sunshine, and, despite the strong wind, some exceedingly good times were made by the sprinters. All praise is due to the officials and their assistants for the admirable arrangements which had been made, and the entire programme was carried out like clockwork to schedule time without a hitch or a flaw. Most elaborately had the grounds been prepared for the event, with gay decorations, seating accommodation, marquees, refreshments, and, to the no small comfort of the competitors, a masseur had been engaged to administer to their needs. The spectators numbered some 2,000, and Callender's Prize Band was in attendance.

Great interest centred in the tug-of-war, for which no fewer than 16 teams contested, Plumsted Police, however, proving victorious. A popular event was the obstacle race, hilarity being provoked as the competitors encountered the swinging bar placed 5 ft. 6 in. from the ground, the greasy board, crawling under a pole close to the ground, the spread canvas, to say nothing of the swinging barrels, and the hurdle and water jump. The race resulting in a dead heat, first and second positions were decided by the spinning of a coin. Another interesting event was the employés' veterans' race, and after six events had been disposed of, the 100 yards was done in 13 sec. from the 10 yards mark by a competitor of 47. The first prize high jump was secured by a junior of 17, who cleared the bar at 4 ft. 11 in.

Ladies also came in for their share of the day's sport in the egg and spoon race.

The prizes were gracefully presented by Mrs. Walker, the wife of the works manager, and after one or two complimentary speeches, dancing was commenced on the green to the accompaniment of music supplied by the works band. Altogether the meeting was pronounced a great success.